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Science Reporter

A CSIR Publication

Multitasking Mobiles!

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- Unique Organisms
- Safe Nuclear Power
- Conserving Drinking Water
- Puzzles, Quizzes & Fiction

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Science Reporter

VOL. 49 NO. 9, SEPTEMBER 2012 ISSN 0036-8512
CSIR-NATIONAL INSTITUTE OF SCIENCE COMMUNICATION AND INFORMATION RESOURCES (NISCAIR)
COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

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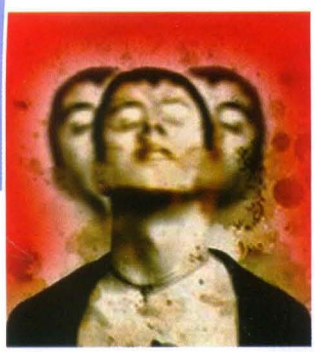
Science Reporter

Split Ends

Schizophrenia – The Stalker in the Head by Shoa Abbas Naqvi (May 2012) provided vivid description of the third most disabling condition in today's world and highlighted the importance of timely intervention, care and medication to prevent a sad ending.



Schizophrenia appears in stages over the years. The third and the last stage leads to loss of normal emotional activities, social isolation which is more subtle & less noticeable but more disruptive in the overall quality of life. At this stage the patient responds less well to medication.

With the advent of magnetic resonance imaging (MRI) & other advanced technologies, researchers are beginning to capture the underlying biological mechanism with greater precision and we may hope for a complete cure in the days to come.

John Nash, mathematician and joint winner of the 1994 Nobel Prize for Game Theory, proved that suffering from Schizophrenia could not be an impediment in leading a highly creative and contributing life.

Partha Ghosh
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Ignorance Harms

Schizophrenia – The Stalker in the Head (May 2012) was very interesting. Such diseases are found in Indian villages also but lack of awareness and knowledge or non-availability of proper doctors are reasons due to which patients do not get treatment and they suffer. Usually in such conditions villagers provide religious explanations and end up only praying, which further harms the patient.

Anupam Maurya
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End of the Road for Humans?

The article **Human Beings: On Way to Extinction** in the May 2012 issue was really thought provoking, logical and very interesting at the same time. One must admit that the article was very well timed too. It is high time we looked at ourselves in the mirror. Are we really brainy? Are we technologically

advanced in the true sense? And, finally, what exactly are we up to?

Mr. Purokayastha rightly pointed out the ultimate paradox – "Human beings think that they can invent numerous things with their brainpower and nature has nothing to do with it. But nobody can deny – every thing happening in our universe is natural." The author also wrote that lack of interest in reproduction (or sex) is going to be the cause of human extinction. May be, but there are other reasons as well.

Our fake pride and false vanity may be another cause of our destruction. For example, in our system a great man is defined as one who devotes and sacrifices his life for the good of mankind but wants nothing in return but a tree in spite of having all those qualities is nothing to us.

This pseudowisdom was identified more than two thousand years ago by Greek philosopher Socrates. He pointed out that nobody knows anything and all knowledge must be incomplete. Human vanity is basically intolerant and Socrates had to face the consequences. The so-called wise men of Athens convicted Socrates and ultimately he had to drink hemlock.

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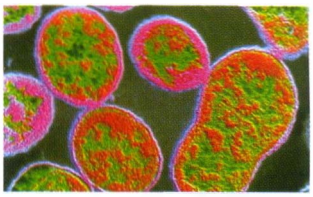
Bio-terrorism

The threat from *Brucella - A Dreaded Bioweapon* has been vividly explained by Dr. Soumana Datta (June 2012). The biological agents of mass destruction are anthrax, small pox, plague, botulinum, haemorrhagic fevers, tularemia, etc. and even a small quantity of anthrax spores can present problems of unprecedented magnitude in a big city like Delhi. It is alleged that Osama Bin Laden was interested in its surreptitious procurement to carry out his diabolical plans.

Since the process of making biological weapons is available on Internet, even small groups with limited financial means, meager knowledge of biology and engineering can develop it at moderate cost and that too in a hush-hush manner.



The threat to India from this menace is very real. From Hamas, a Palestinian terrorist group which is believed to possess it, BWs could travel to Afghanistan, Pakistan and beyond through dedicated Al Qaeda, Taliban and LeT networks. Even the US in its own territory is not prepared to effectively deal with the BW problem. Our preparation in this regard is anybody's guess.

Dr. S.K. Gurtu
Mansarovar, Jaipur

Last Transit

The cover story, **Last Transit of Venus in the 21st Century** by Prof. Smiles Mascarenhas endowed us with an insight into a rare happening. It was far more informative than any other source. The article has also thrown light on the genius that flourished within the medieval scientists and their innovative ways to observe a Venus transit.

I feel that the interest for astrophysics is declining a bit here in India. But the article published in your magazine will surely add to the interest of the students towards astrophysics.

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HAVE YOUR SAY

If you feel strongly about any article or write-up published in *Science Reporter* or have some information to share with the readers, please write to us at the postal address given in the magazine or send an Email at sr@niscair.res.in.

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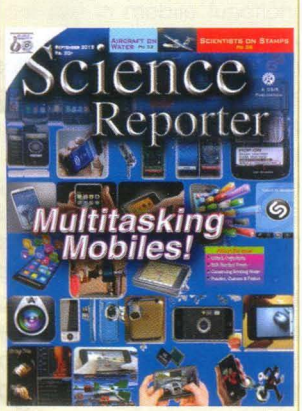
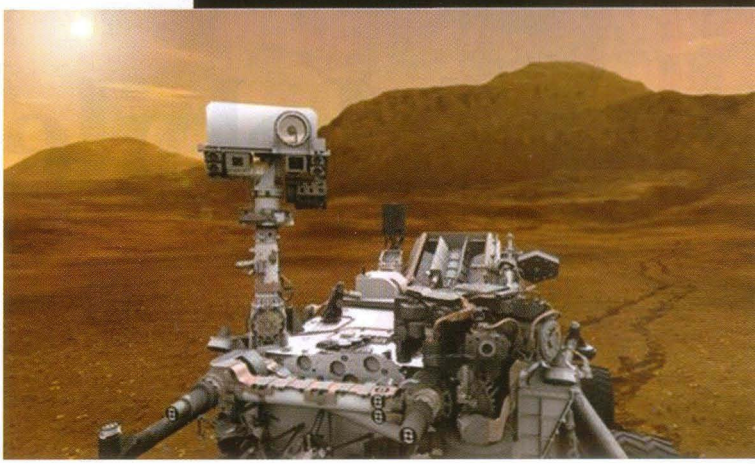


COVER DESIGN
NEERU SHARMA

CURIOSITY LANDS ON MARS

Curiosity about Mars has always been high in the minds of humans. Earthlings have always been at the receiving end of 'attacks' from highly advanced 'Martians' in science fiction movies and stories. Life on Mars has always been a contentious and hotly debated topic in scientific circles too.



And so, when *Curiosity*, NASA's Mars science rover, landed on the Martian surface on 6 August 2012, a collective cheer went out at NASA's Jet Propulsion Laboratory. The rover landed in the Gale crater on Mars after completing an eight-month long journey across 355 million miles. And immediately thereafter it sent in its first photographs of the Martian surface.

The $2.5 billion *Curiosity* project, formally called the Mars Science Laboratory, is indeed an engineering marvel and one of the most complex robotic space flights. With only about 40% of Mars missions having tasted success the odds were stacked against the NASA engineers. However, the car-sized rover was guided on to the surface of Mars with almost near precision and without any major mishap surviving what has now come to be popular billed as the "seven minutes of terror". These were the seven minutes during which *Curiosity* was expected to complete a series of high-risk, automated manoeuvres slowing it from an entry speed of 20,000 km/h to allow it a soft landing.

In the two years that the rover is expected to be operational, *Curiosity* will scoop up samples of soil and pieces of rocks and analyze them in its onboard laboratory to search for chemical building blocks of life (e.g., forms of carbon) on Mars. It will also try to find out what the Martian environment was like in the past and whether conditions have been favorable for microbial life. Apart from *Curiosity,* there is another rover – *Opportunity* – on the surface of Mars beaming signals back to Earth and three orbiters currently surveying the planet (*Mars Odyssey, Mars Express*, and *Mars Reconnaissance Orbiter*).

Meanwhile, Prime Minister Manmohan Singh in an address to the nation on the occasion of the country's 66th Independence Day announced India's own Mars mission. The Cabinet has approved the Mars Orbiter Mission that will involve sending a spaceship to Mars making it the sixth country to launch a mission to the Red Planet after the U.S., Russia, Europe, Japan and China.

The Rs. 450 crore Mars Orbiter Mission might be launched in November next year with a 25 kg scientific payload. To be launched from Sriharikota in Andhra Pradesh by an extended version of the Polar Satellite Launch Vehicle (PSLV), the spacecraft would take nearly 300 days to reach the Martian orbit. The orbiter will be placed in an orbit of 500 x 80,000 km around Mars. The spacecraft will study the climate, geology, origin, evolution and sustainability of life on the planet.

If the Indian Mars Orbiter Mission is successful, India will be the first Asian country to do so as probes sent by China and Japan had to be abandoned en route.

Hasan Jawaid Khan

Printed and published by Deeksha Bist on behalf of the National Institute of Science Communication And Information Resources (NISCAIR), CSIR, Dr K S Krishnan Marg, New Delhi-110 012 and printed at Brijbasi Art Press Ltd., A-81, Sector-5, Noida-201 203.
Science Reporter is published monthly by the National Institute of Science Communication And Information Resources (NISCAIR), CSIR, Dr K S Krishnan Marg, New Delhi-110 012. NISCAIR assumes no responsibility for statements and opinions advanced by the authors or for any claims made in the advertisements published in *Science Reporter*.

For Editorial Queries: Ph.: 91-011-25848702; **Email:** sr@niscair.res.in; **Fax:** 91-011-25847062
For Sales & Subscription Related Queries: Ph.: 91-011-25841647, 25846301 Extn. 286; **Email:** lkc@niscair.res.in
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Subscription: Inland: 1 yr: Rs 200/-; 2 yrs: Rs 380/-; 3 yrs: Rs 540/- Foreign: 1 yr (Air Mail): US $ 65
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NITIN KUMAR AHIR

Mobile Phone 'Apps' at your Service!

Advances in electronics and computing and their integration have turned the modern mobile phone into a mini computer. Mobile phone applications, or apps as they are called, enhance its information and communication capabilities. With features like GPS, motion sensors, cameras etc., stand-alone devices are fast becoming obsolete for non-specialized uses.

THE word 'mobility' signifies ease of movement. Our lives are deeply intertwined with technologies that aid our business and personal lives. Today's mobile phones lie at the convergence of electronics, computing and consumer usability considerations. Advances in electronics and computing have aided miniaturization of the mobile device, while retaining (and possibly enhancing) the complexity of its functionality. The popularity of certain information, communication and entertainment modalities and consideration of user experience with mobiles has also influenced software and device design.

Various features of the new mobiles have made these technologies available in a single device by making the hardware compact, and offloading sophisticated functionality onto the software. Carrying one device containing all business and personal technologies gives users flexibility in their communications, even as they move around in different places.

Mobile phone applications, popularly called 'apps', are the nuts and bolts of the smartphones. Apps are programs routinely used in devices like smartphones, iphones, tablets etc. to make their functions work in the desired manner. Apps can be divided into two types: Native Apps and Web Apps.

Native Apps work offline and only on one platform i.e. operating system. They work efficiently and effectively as the relevant data is present inside the device only. Examples of native apps include radio, calender, calculator, pictures, instant messaging etc. On the other hand, web apps work online and are platform-independent. They are browser-rendered, so they are made using HTML programming language. Web Apps sometimes are slower as the data is readily not available as it fetches the data via the Internet service provider. Once data is obtained, the web app starts working i.e. loading the webpage, browsing websites and downloading items. Examples of web apps include Facebook, Twitter, Hi5, Friendster etc.

To run mobile apps, an operating system (OS) or platform is required. An OS platform manages the hardware and software resources of the device and controls all its basic operations. Operating systems are like the heart of the mobile phone; without it the device is just like a piece of metal in our hand. A good interactive interface linked to the OS is important; it keeps the device functioning according to the user requirements. Some examples of operating systems are Android, Mac, Windows Mobile, RIM (for Blackberry), MeeGo, SHR etc.

The OS platform provides the base for the application developer to develop different kinds of apps. It is very necessary to have proper knowledge of the operating system to create an application for the mobile phones.

Operating Systems	iOS	Android	Windows Mobile	Windows Phone	Blackberry OS	Symbian
Owned by Company	Apple	Google Inc.	Microsoft	Microsoft	RIM	Symbian Foundation
Programmed in	C, C++, Objective C	C, C++, Java	Many, C++, NET, Lazarus	Many, .NET (Silverlight)	Java	C++

Another important criterion to be followed while creating new apps is that it should be user-friendly. Even if the mobile has sophisticated features, it would be useless if the user is not able to operate it. Hence, the operating system plays a vital role in mobile functionality – from making the apps to their actual performance in the hands of the user.

There are many different kinds of operating systems like iOS, Android, Windows Mobile etc. that are designed and programmed in many different languages. The simplicity and versatility of programming language is the key criteria in designing operating systems and newer apps for the phones. Some OS like Android from Google Inc. are free and open-source, whereas others like Blackberry OS from RIM are proprietary.

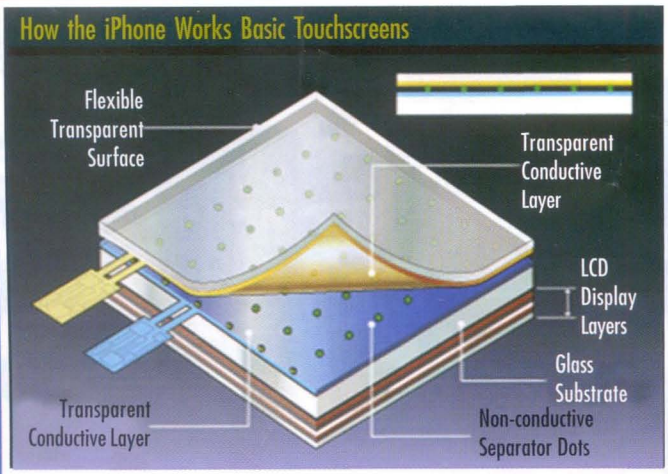
Let us take a look at some useful applications in today's cutting-edge mobile phones and see how they work.

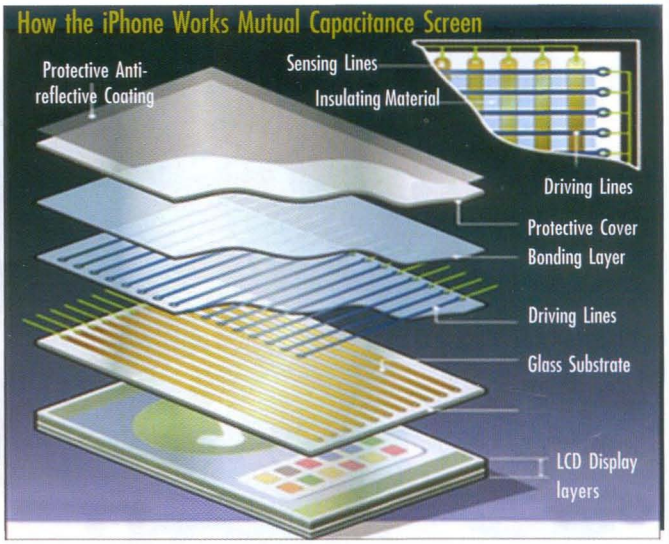
Touch Sensitivity

Earlier, devices like tablets and touch screen-enabled computers worked by using a resistive screen composed of a thin layer of flexible polyester film over a layer of glass or plastic. These layers were crisscrossed with near-invisible wires. When the user touches the screen, the top layer is pushed towards the lower layer and these wires intersect. This changes the flow of current, which in turn helps in determining the location of the touch on the screen.

Nowadays, the touch screens are capacitive and have uniform sensitivity. For example, in iPhone, capacitors are arranged according to a coordinate system. When the user touches the screen, it generates electrical impulses. This signal travels from the screen to the processor. The processor uses software to analyze the features of the touch i.e. the size, shape and location of the affected area on the screen. If necessary, the processor arranges 'touches' with similar features into groups.

For example, if you move your finger, the processor calculates the difference between the starting point and ending point of your touch. In this way, the gesture interpretation software of the processor combines the physical movement of your





finger with information about which application you were using and what the application was doing when you touched the screen. The processor then relays your instructions to the program in use. If necessary, it also sends commands to the iPhone screen and other hardware. We can see changes on the screen based on our input almost instantly. If the raw data doesn't match any applicable gestures or commands, the iPhone disregards it as an extraneous touch.

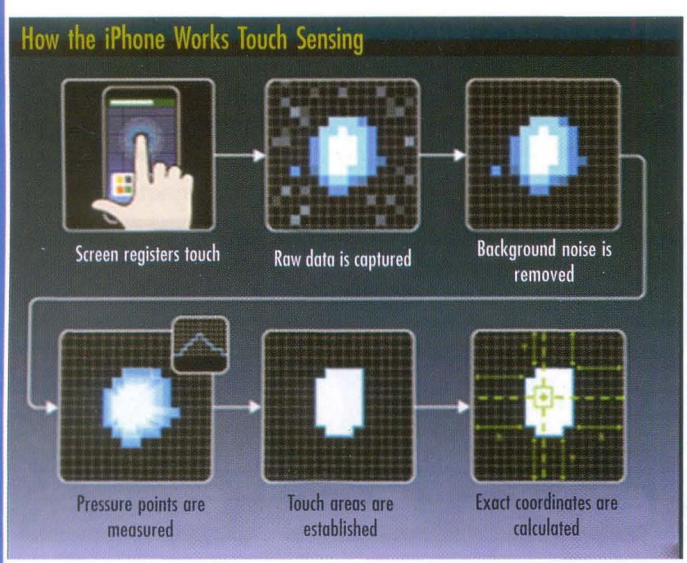
Touch screen mobiles are more user-friendly than keypad mobiles. Rather than pushing lots of buttons, it is much easier to touch and type a message. In the earlier keypad phones, users had many problems with the keypads. Buttons would not work properly due to various reasons. Sometimes a water droplet would find its way inside and the whole keypad would stop working and would need to be replaced.

Today's touch screen mobile phones are free of such issues. Custom apps are linked almost entirely through computational means, ready to be summoned at the user's touch. In addition, these apps are popularly used means of communication, information and entertainment, which minimizes the need for the user to give a lot of instructions. Many games are now much easier to play on the mobile. New games have emerged that take advantage of the responsiveness of touch screens, like piano, guitar and Burning the Candle. With one touch we can listen to music, play videos and do a lot more things in the touch screen mobile phones.

Voice Recognition

For many years, we could control our mobile phone only using its keypad. Later, technology companies and audio engineers tried to perfect voice recognition software to assist the blind and physically disabled to communicate through voice. Voice recognition software used is speaker-independent, where there is no need of training to understand our voice.

The emergence of smartphones in the last decade changed the entire scenario. Speaker-independent voice control was either built into the phone or offered through apps. The processing power and speech recognition were built into the phone with limited speech commands. The majority of the applications in mobile phones that work on voice command of the user mostly rely on Automatic Speech Recognition (ASR) with the help of which the user can use dialing, phone book search and various applications of the mobile phones. Most Smartphone users who have tried Android phones are familiar with Google's speech recognition software, which is used mostly for navigation, mapping, making calls and launching programs.


How the iPhone Works Touch Sensing
Screen registers touch
Raw data is captured
Background noise is removed
Pressure points are measured
Touch areas are established
Exact coordinates are calculated

BLUETOOTH

Bluetooth is a short-range wireless technology that allows computers, phones and other devices to talk to each other over short distances (up to 100 meters). Bluetooth uses radio waves (in the 2.4 Gigahertz range) and is designed to be a secure and inexpensive way of connecting and exchanging information between devices without wires. It is also being used for connecting and transferring information between devices such as mobile phones, laptops, PC's, PDAs, printers, digital cameras, mouse and keyboards. Wi-Fi networks and Bluetooth are the wireless hotspots in today's time and are almost 20 times faster than the earlier versions. With the latest technology of Bluetooth (version 2.0), devices can hence achieve data transfer speeds up to 2 Or 3 Mbps(megabits per second).

Why the name Bluetooth? The name comes from the ancient King Harald Blatan of Denmark (Blatan in Danish translates to "blue tooth" in English). Sweden-based telecom company Ericsson developed the technology and was co-founder in 1998 of the Bluetooth Special Interest Group governing body (www.bluetooth.com). Bluetooth is also standardized as an IEEE wireless personal area network

The Automatic Speech Recognition (ASR) technology converts a speech signal into a text message transcription of the spoken words. When a speaker utters a stream of words, usually interspersed with pauses and utterances like 'uhh' and 'umm', the software produces a speech waveform representing the words of the sentence as well as the extra sounds and pauses in the spoken input. The fragments of the sentences are then measured based on their amplitude and the level of compression of air released from a person's mouth. The software then attempts to syntactically decode the speech into the best estimate of a sentence. A microphone present in the phone uses ASR and analog-digital converter to convert the analog data into digital data.

Many users have adopted smartphones as voice recognition is an attractive feature for them. Voice recognition increases the interactivity, convenience and flexibility with the mobile compared to touch. Besides, it can also be useful to people who cannot see or are unable to operate the mobile by touch.

Global Positioning System

Global Positioning System, or GPS, is one of the most widely used technologies in the communication world. GPS navigational systems are supported by a network of 27 satellites, which orbits the Earth in a cyclic pattern every twenty-four hours. At any given time, signals from a minimum of four satellites are accessible to any one point on Earth. Whenever a receiver device is activated, radio waves are sent out. A receiver's exact location is determined through a process called triangulation where three satellites work together to track down possible location points, while a fourth satellite compiles the data and picks out the exact location. Distance calculations are made based on how long it takes the radio signals to travel back and forth between the receiver and the satellites.

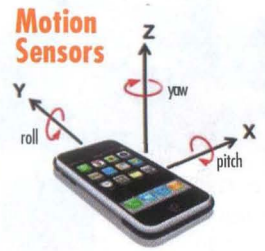
A GPS tracking system uses the Global Navigation Satellite System (GNSS) network. This network includes a range of satellites that uses microwave signals that are being transmitted to GPS devices to give information on location, vehicle speed, time and direction. So, a GPS tracking system has a potential to provide the real-time and past navigation data on any kind of journey.

Location tracking by providers in case of an emergency and giving navigation directions are other uses of this technology in mobile phones. A mobile phone also works like a two-way radio when communicating with the cell phone towers and the GPS capability of phones simply extends the radio signals to reach out to the space satellites.

The receiver device can be located inside the phone itself, or the user can use a wireless connection like a Bluetooth connection. Mobile phones work on Java-based programs and have database access to their provider's system. The mapping capabilities are displayed on the phone's screen via the cellular provider's database. The accuracy of these maps depends on how frequently your provider updates the database.

Mobile Camera

While cameras in earlier mobile phones were based on Visual Graphics Array (VGA) technology, most new mobile cameras are digital. So, did you ever notice how a picture is taken by your mobile camera and stored?



Digital cameras comprise of various kinds of chips. When the light from the object falls on the camera's digital sensor's pixels, they become excited with an imprint of the object. This imprint is passed through a colour filter that creates analog electric signals from light signals. This analog signal is converted to digital signal with an analog to digital signal converter. Then these signals are saved in chips known as memory cards, a location from which the image of the object we captured is recomposed.

The main working chips – the pixilated digital sensors – are Charged-Couple Devices (CCDs) and Complementary Metal Oxide Semiconductors (CMOSs). CCD is a silicon chip used to detect light and convert light photons into electrical energy (video). CMOS is a semiconductor chip that operates on the same principle as CCD chips but differs in quality. CMOS provides much better quality images, consumes less energy and is also less expensive than CCD based cameras. Today, most cameras in mobile phones use CMOS image sensors over CCD based cameras because of the reduced power consumption and are also cheaper to manufacture.

As compared to the VGA cameras, pictures we obtain from CMOS based camera chips have much better quality. People are increasingly going for mobile phone cameras with much higher pixel quality, and even starting to prefer mobile phone cameras rather than purchasing stand-alone picture cameras. Not only do they get most of the features associated with the digital camera, mobile cameras also tend to be much lighter than stand-alone picture cameras. Having a camera built into the mobile is handy to take pictures, such as when you need to record evidence in situations like vehicle accidents and during crimes, as well as record unplanned cherished moments.

Motion Sensors

Motion Sensors sense the change in the position of an object relative to its surroundings or vice versa. The motion sensor used in mobiles is known as accelerometer, which measures linear acceleration. Using this measurement, it translates motion into action on the screen. Earlier the accelerometers worked on one-axis to two-axis. Today's advanced accelerometers have moved to multi-axis (i.e. six-axes: up and down, left and right, forward and backwards) measurement capabilities by which their accuracy has increased. Modern accelerometers are often small micro electro-mechanical systems (MEMS).

Accelerometers have provided many applications on mobile phones. They allow you to monitor a fitness workout by measuring the number of steps you take, your speed and the calories burned. As it is capable of detecting rotation and motion gestures such as swinging and shaking, mobiles can also used as gaming controls instead of pressing keys. Accelerometers can also measure the force of acceleration, whether caused by gravity or by movement, and the angle at which the mobile is being held bythe help of which it automatically adjusts the visual output to make it appropriate to the direction of the screen. In this way we can view lists with the screen held vertically and watch videos with the screen held sideways.

Accelerometers have enabled the mobile processor to function more efficiently than the earlier phones by preventing incorrect key depressions from being processed. Such ambiguities are avoided in the upcoming mobile phones, which helps in efficient functionality of the app.

IMEI Number

Although this is not an app, IMEI Number is something all mobile users should be aware of. IMEI is the acronym for International Mobile Equipment Identity. This

IMEI Number

GENERATIONS OF TELECOM TECHNOLOGY— DRIVING MOBILE APP INNOVATION

G stands for generations of wireless telecom connectivity. These generations are the standards for telecom infrastructure, and are thus linked to the efficiency and functionality that can be derived from associated telecom devices. Generations are also aspirational – they are set based on cutting-edge developments in technology and motivate telecom companies and countries to upgrade their technology and infrastructure. For example, 5G standards promise amazing bandwidths and mobile phones that are free of country-based networks.

1G: 1G signifies first-generation wireless analog technology standards that originated inthe 1980s, and includes Time Division Multiple Access and Frequency Division Multiple Access. The first commercially automated cellular network 1G was launched in Japan by NTT in 1979. The main technology development that distinguished the First Generation mobile phones from the earlier cellphones was the use of multiple cell sites and the ability to transfer calls from one site to the next as the user travelled between cells during a conversation. In a cellular system, a signal between a base station (cell site)

and a terminal (phone) only needs to be strong enough to reach between the two, so the same channel can be used simultaneously for separate conversation in different cells.

2G: 2G signifies wireless digital technology that replaced analog 1G, and includes FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access) and CDMA (Code Division Multiple Access). All types have one common feature of multiple access which means that many users are able to use the same number of cells. 2G started working with GSM (Global System for Mobile) standard as a communication medium. In addition to the GSM protocol, 2G also utilizes various other digital protocols including CDMA, TDMA iDEN and PDC. GSM is based on TDMA.

GSM technology was the first to help establish international roaming, as it was based on digital signals. The second generation introduced a new variant of communication, SMS or text messaging, initially on GSM networks and eventually on all digital networks. 2G technology holds sufficient security for both the sender and the receiver due to digital encryption of messages. Digital signals consume less battery power, so it helps mobile batteries to last long. Digital coding improves the voice clarity and reduces noise in the line. Digital signals are considered environment-friendly. The use of 2G technology requires strong digital signals and good network coverage to help mobile phones work.

3G: 3G networks are built to handle the needs of today's wireless users, with faster data-transmission speeds, greater network capacity and more advanced network services. 3G technology was also known as CDMA Wireless technology. It is the first wireless technology that provides broadband-speed Internet connection on mobile phones. The first pre-commercial 3G network was launched in May 2011 by NTT DoCoMo in Japan. The main advantage of 3G networks over 2G networks is speed. This standard of wireless networks increases the speed of Internet browsing, pictures and video messaging. Technically, the main difference that distinguishes 3G technology from 2G technology is the use of packet switching rather than circuit switching for data transmission. Later 3G technology began to be implemented, namely High-Speed Downlink Packet Access (HSDPA).

4G: The objective of 4G is to become a fully IP-based system, much like a modern computer network. The supposed speeds for 4G will be higher that 3G, and can provide Internet speeds up to 1 GBPS! One of the main ways in which 4G differs technologically from 3G is that circuit switching will be eliminated, and an all-IP network will be implemented in its place.

4G will be able to overcome the problems of weak network strength and should provide a much wider network, making sure that the users get high-speed connectivity anytime anywhere. No doubt, 4G will open new doors of revolutionary Internet technologies. 4G promises voice, data and high-quality multimedia in real-time all the time and anywhere.

Some useful apps that utilise internet-enabled infrastructure are:

1. Talking tom: This is the app that has a cat that just repeats whatever you say in the same manner and in a funny voice. This app works in the same way as the voice recognition software. This app takes the command or instructions from the user through the microphone and processes it.

2. You Tube: This app works online. It works the same as the real youtube website works. With the help if this app, the user can watch videos at any time and can play for any occasion he/she likes. Users can even upload their own videos to the Youtube app. For this the user need not open the browser and type 'youtube'; instead the user can just touch the app and it becomes available in a jiffy.

3. MS Office: Nowadays, even the MS Office app is being provided on smartphones so that the user can make or view documents or PowerPoint files.

4. Shazam: This is another online app that works using the microphone and then checks with the online database to give the user the desired output. For instance, you hear a song and want to know who is the singer or from which album it is? The app will 'listen' to the song and search for its details in its database and give you the details.

5. Online Dictionaries: You want to know the meaning of a difficult word. No need to carry the entire dictionary along with you; instead this app, which has its own database of a large number of words, will fish out the meaning for you instantly. In case it does not have the meaning of a certain word, it would ask the user to go online and search for the word's meaning.

6. Internet Radio: It is an app that helps you listen to the radio through the Internet. Just connect to the Internet radio app, it will automatically scan all the stations and let you listen to your most favourite songs.

Native Apps work offline and only on one platfor operating system. They work efficiently relevant data is present inside the device only.

code is a unique number associated with every mobile phone and can help us to find our stolen cell phone easily. We can find our mobile phone's IMEI number by dialing the sequence *#06# into the phone. The unique 15-digit IMEI code of the mobile phone will be displayed instantly. Note this number down and keep it in a secure place so that you can find it in case your phone is misplaced or stolen. You can also find the IMEI number by checking the metallic plate under the battery, after making sure that power is switched off.

In case your mobile phone gets lost or stolen, you can inform yours network provider who can then put the IMEI number on a shared database. This will prevent that particular phone from being registered on any network. Thus, it will be useless for a thief even if the mobile phone's SIM card is changed. And then, by the use of GPS, the phone could be tracked. This IMEI number is also required to unlock the mobile phone and get it working once it is found.

In case your mobile phone doesn't have the IMEI number then you are in trouble! The Department of Telecom (DOT), Ministry of Communications and Information Technology, Government of India has directed cell phone operators to disconnect mobile phone handsets without legitimate International Mobile Equipment Identity (IMEI) number from 1 December 2009. This has been done to counter threats to national security, as many crimes have been aided by phones that cannot be easily tracked. So check your cell phone and replace it if it does not have a proper IMEI number to prevent misuse of your phone.

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RASHMI REKHA AND HIMANSHU SHEKHAR

Composite Gas Cylinders

HOUSEWIVES often face a common problem while cooking: They don't know whether there's enough gas left in the LPG (liquefied petroleum gas) cylinder to cook the next meal. This problem can be solved by the introduction of cylinders in which the level of available gas in cylinder will be visible by naked eyes. These are lighter and transparent fibreglass domestic cooking gas cylinders. Let us first take a look at cooking gas and the conventional cylinder.

Domestic Cooking Gas

Liquefied petroleum gas (LPG), used as domestic cooking gas in around 40% houses of India, is a mixture of hydrocarbons. As per government definition "liquified petroleum gas" means any material that comprises predominantly of any of the following hydrocarbons or mixture of them with vapour pressure not exceeding 16.87 kg/cm² (gauge) at 65° C – propane (C_3H_8), propylene (C_3H_6), butane ((C_4H_{10}), (n-butane and iso-butane) and butylene (C_4H_8).

Domestic cooking gas is a mixture of propane and butane and has a very high energy content (calorific value = 46.1 MJ/kg). LPG is a low carbon emitting hydrocarbon fuel, emitting 19% less CO_2 per kWh than oil and 30% less than coal. The gas can be liquefied at moderate pressure, and can be stored in cylinders as a liquid under pressure, and is drawn out and used as gas. LPG is a colourless and non-poisonous gas. However, at the time of production, mercaptan (a chemical compound) is added to it so as to give the now familiar foul smell for easy detection of gas in the air. Even very small quantities of gas can be detected by this smell.

Since LPG is almost twice the weight of air it tends to settle down at floor level, particularly in depressions. Hence, care has to be taken in placing the gas installations in the house. Also the fact that 1 cubic centimeter of liquid LPG expands to about 270 cubic centimeters of gaseous LPG, helps it spread very rapidly in the atmosphere. Hence, if a gas cylinder leaks, it should be immediately removed to an open area.

Cylinders for Cooking Gas

As per Indian government norms, the domestic cooking gas cylinder should be made in two halves welded at the centre. It should be made of welded low alloy steel conforming to IS:14899 specification. However, cylinders of other origin like Austria, Argentina, China, Italy, Spain, Japan, Poland, UK, USA and Germany are also adopted in India.

Since LPG is inflammable and accidents due to cylinder burst are regular headlines in newspapers, utmost care must be taken to store, use and transport the cylinders. Liquefied petroleum gas cylinders should always be kept in an upright position and placed such that they cannot be knocked over. Condensation on the body of the cylinder metallic is an indication of higher than specified consumption rate of cooking gas. This must be watched and corrected in time to prevent any eventuality.

All gas cylinders have a marking pertaining to their shelf life. Each cylinder necessarily undergoes hydro-testing after 10 years and subsequently at each 5 years. The date of next hydro-proof pressure test is indicated on one of the three stay-plates (top section) of the metallic cylinder in alphanumeric codes. The first letter is an alphabet A, B, C, or D indicating quarter of year. It is followed by two numbers indicating year of next testing. For example, B15 means next proof pressure test for the cylinder is due in second quarter of 2015.

Depending on the metallic sheet used in manufacture of cylinders, the weight is found to vary from 15.5 kg to as high as

Composite material offers several advantages over conventional metallic counterparts. It has very high strength to weight ratio, has excellent corrosion resistance and good fire retardant properties can be introduced by incorporating special additives. Higher internal damping, less catastrophic burst failure, better dimensional stability due to low coefficient of thermal expansion, lower life cycle cost, improved appearance and smooth surface make composite materials an obvious choice for various applications.

18.5 kg. This variation adversely affects the gas-supply and at times results in short supply of LPG gas to consumers. Plastic seal of LPG cylinder is applied at the cylinder valve at a temperature of 225°C. It costs around 40 paise per seal and is procured from local market for the LPG bottling plants. Since gas cylinders are metallic right from their inception, composite gas cylinders are being viewed as the next generation gas cylinders.

Composite Gas Cylinders

Metals, plastics, ceramics are considered materials with different distinguishing characteristics and composite materials are mixtures of two or more of these. Bones, wood etc are naturally occurring composite materials. Reinforced cement concrete is the modern incarnation of the composite material concept. In modern scenario, composite materials are fast getting introduced as aircraft structures, car-bodies, railway coaches, boat construction, naval crafts, storage tanks and vessels, engine pistons, sewer pipes, polymer concretes for dams, roof-light sheets, electrical masts and spars, chairs, tables, implants, sport-goods, cooking utensils, personal armours, etc.

A composite material offers several advantages over conventional metallic counterparts. It has very high strength (or stiffness) to weight ratio. It has excellent corrosion resistance and good fire retardant properties can be introduced by incorporating special additives. Higher internal damping, less catastrophic burst failure, better dimensional stability due to low coefficient of thermal expansion, lower life cycle cost, improved appearance and smooth surface make composite materials an obvious choice for various applications.

A see-through, lightweight, safe, eye-catching, environmental friendly cooking gas cylinder made of fiberglass will be an asset for kitchens of the future. Composite gas cylinders apart from imparting maximized strength and optimized safety, also offer additional advantages like non-corrosive construction, high strength to weight ratio, light weight, and explosion-proof fabrication making this an obvious alternative for domestic cooking gas cylinders. This type of technology needs adaptation for many other reasons also.

In India, LPG supply is highly subsidized (50%) and is theft prone also. Some distributors take out the LPG from the cylinders by filling water up to 2 kg and the water remains in the cylinder even at the time of refilling at bottling plants. Additionally, wide variation in weights of LPG cylinders (15.5 kg to 18.5 kg), erroneous tare weighment during bottling, black-marketing are some of the menace for which this composite domestic gas cylinder is considered a panacea.

In a LPG bottling plant, automatic LPG filling system called carousal is adopted. It has 24 nozzles and can undergo one rotation in 65 seconds giving a time of 2.5 seconds per cylinder to the operator for tare neutralization. This frequently leads to erroneous gas weight in the cylinder and the specified variation of $\pm$ 150g over 14.2 kg gas is seldom maintained. The plastic seal costs too less for any malpractices. The use of gadgets like Bansuri, etc. has been reported widely to take out cooking gas from filled cylinders before resealing it. Cases of filling the cylinders with 1-2 kg of water displacing LPG gas has been reported from many parts of the country. A see-through visible gas level will put an end to all such malpractices.

The major problem with use and propagation of composite cylinder is high cost of fabrication. The cost is priced at around Rs 3,500 per cylinder in comparison with Rs 950 for steel cylinders. However, the cost is largely justified in view of enhanced safety, correct and justified return on investment, higher buying capacity of domestic LPG gas users, prior intimation of available gas level, light weight and next generation tag.

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New Cloud Physics Laboratory in India

A High Altitude Cloud Physics Laboratory, the first of its kind in India, has been established at the famous hill station of Mahabaleshwar in the Western Ghats range near Pune. It will start collecting data in the current monsoon season.

Perched 1438 meters above mean sea level, the Rs 35 crore laboratory of the Ministry of Earth Sciences (MOES) will house state of art instruments for observations including a "sky imager" with an additional installation of an X-band radar at the nearby Mandhar Devi hill for continuous monitoring of "growth and decay" of clouds under different environmental conditions.

The bases of clouds in India in the monsoon season are between 1000-1500 m above sea level. However, Mahabaleshwar being about 1,400 metres high, the clouds are at the surface. This provides a unique opportunity for observations. An additional advantage is that the monsoon clouds formed over the Arabian Sea arrive first over Mahabaleshwar.

Dr G. Pandithurai, scientist working at the Pune based Indian Institute of Tropical Meteorology (IITM) is the project-in-charge. IITM will also manage the laboratory. The laboratory is being described by IITM scientists as a "milestone in the history of atmospheric sciences in India".

Contributed by Mr G.V. Joshi, E-2/11 Girijashankar Vihar, Karvenagar, Pune - 411052

Polished Rice Smoothens Path To Diabetes

Soon India is going to earn the dubious distinction as the diabetic capital of the world. Almost negligible a few decades ago, the disease has now spread its tentacles among nearly 160 million people globally, of which almost one-fifth are Indians. In India the number of people suffering from it may swell up to reach the 40 million mark from the present 30-32 millions by the year 2030, when it may turn out to be the number one killer among non-communicable diseases.

Diabetes can be of type-1 or type-2 (the third kind, known as gestational diabetes affects only women during pregnancy). The first one sets at an early age, as it is hereditary and is related to chromosomes 6 and 11. Such patients are completely insulin dependent, as they fail to secrete this hormone adequately. On the other hand, type-2, the most prevalent one is generally seen in adults and elderly people. Its susceptibility is also hereditary, but is termed as insulin independent, as it can be controlled by adopting healthy food habits, regular exercises and use of medicine. However, this is the one that is now spreading like an epidemic.

While sedentary life style is mostly blamed for the dreadful scenario, unhealthy food habits such as, fast food, and others of the kind, rich in refined starch, fat, salt and sugar containing very little natural ingredients like dietary fibre, minerals and vitamins also have a major share in it. To make the situation more alarming, a recent research finding published in the *British Medical Journal* (16 March 2012) has linked polished

Plight of Salkhan Fossil Park in Uttar Pradesh

The Salkhan Fossil Park, also known as the Sonebhadra Fossil Park is located 12 km away from Robertsganj on the Varanasi-Shakti Nagar highway in Sonebhadra district of Eastern Uttar Pradesh. The Park is well known for its very old fossils, some around 1400 million years old dating back to the Mesoproterozoic period, making them one of the oldest fossils in the world.

The Park is spread over an area of about 25 hectares inside the Kaimoor Wildlife range and comes under the jurisdiction of State Forest Department. An internationally renowned Canadian Geologist H.J. Hofmann was surprised after seeing the Salkhan Fossil Park. According to him, nowhere in the world were there such beautiful and clear fossils.

The fossils at the Salkhan Fossil Park are often compared with the fossils at Yellowstone Park in USA. Being older, the Salkhan Fossil Park is fully mature while the Yellowstone fossils are immature. The Salkhan Fossil Park is three times larger than the Yellowstone Park. However, the Yellowstone Park earns a revenue of about Rs. 300 crore annually from the 4 million visiting tourists.

The fossils appear as rings on the boulders scattered around the area. The fossil types found in Salkhan Fossil Park are algal stromatolites. The stromatolites are sedimentary structures consisting of laminated carbonate or silicate rocks produced over geologic time by the trapping, binding or precipitating of sediment by groups of microorganisms primarily cyanobacteria (blue green algae). The stromatolites are the oldest fossils found on the Earth. They are fossil evidence of the prokaryotic life that remains today, as it has always been, the preponderance of biomass in the biosphere. Palaeobiological studies reveal that the fossil stromatolites of the region are dominated by the mat-forming colonial cyanobacterium of the genus *Eoentophysalis* (Family-*Entophysalidaceae*), ellipsoidal akinetes (asexual spores) of *Archaeollipsoides* (Family-*Nostocaceae*) and its vegetative cells of spherical shape.

The fossils here are in a neglected state. The main hurdle for the development of the Salkhan Fossil Park is that it is located in a remote forested region. There are no arrangements for the protection of this invaluable fossil park. The barricading wire surrounding the fossil park has been stolen and people take shortcuts through the park to reach different destinations, often damaging the fossils. The shattered fossils pieces are also collected and carried by the local population passing

While sedentary life style is mostly blamed for the dreadful scenario, unhealthy food habits such as, fast food, and others of the kind, rich in refined starch, fat, salt and sugar containing very little natural ingredients like dietary fibre, minerals and vitamins also have a major share in it

white rice, the staple food of most of the people of Asia and more than half of the people of the world, with type-2 diabetes. According to it, each serving (nearly 160 g) of such rice a day increases the risk by 11%, and more the consumption, greater is the risk.

The authors from the Harvard School of Public Health, Boston have arrived at this conclusion after undertaking a meta-analysis of 3,52,384 people belonging to China, Japan, the US and Australia, who were followed up for 4 to 22 years. According to it, the association between polished rice and type-2 diabetes is more significant in case of the rice-eating Asians (Chinese and Japanese). However, among the Americans and the Australians, an estimated 167 new cases of diabetes per one lakh people would occur every year for every additional serving of polished rice a day, they pointed out.

Earlier, a study conducted by a team of researchers led by Dr. V. Mohan under the project CURES (Chennai Urban Rural Epidemiology Study 2001) had found a similar link between diabetes (type-2) and dietary carbohydrates in general and polished white rice in particular. The results of further studies were published in the *British Journal of Nutrition* (20 August 2009) in which they had pointed out that the risk & factor increased with age, sedentary life style, body mass index and quantity of carbohydrates consumed. According to them, of the 1,843 persons examined from in and around Chennai, the lowest quartile consumed about 320 g of polished rice per day as compared with 516 g by those in the highest quartile. The incidence of type-2 diabetes was more common among the later.

Both the present and the earlier teams of researchers agree that polishing of rice removes the bran and the germ, rich in insoluble fibre, protein, lipids, vitamins (particularly B-Complex), magnesium and lignins (that act as anti-oxidants). Insoluble fibre and magnesium have known effects in lowering the risk of type-2 diabetes. Besides, rice bran lipids contain more of polyunsaturated fatty acids, particularly the Omega-3 type, which removes bad cholesterol from the body and helps in reducing obesity, another cause of diabetes.

On the other hand, carbohydrate rich polished rice has a high glycemic index, i.e. it has a high glucose raising effect. Therefore, polished rice has two-pronged harmful effect – it removes essential nutrients and increases glycemic index. In order to overcome this problem it is better to go for hand pounded rice, which has become very rare in the market today. In such a case, a maximum of 2% polishing should be recommended and not 8 to 10%, as is done to get super white rice.

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through the park. Due to lack of barricading the fossil park is open to grazing animals as well. The unprotected fossil park is also open to antique smugglers. The park is even threatened due to illegal mining in the area.

The State Forest Department recently made a provision to construct a road connecting the fossil park with the highway. However, such work has not helped in any way in the restoration of the invaluable park. The Sonebhadra district is also affected with the problem of Naxalism.

Therefore, the plight of the Salkhan Fossil Park is a matter of serious concern and needs immediate attention. There is need to declare the Salkhan Fossil Park as a 'National Geological Heritage'. The development of Salkhan Fossil Park as a tourist spot will generate revenue and will also be helpful in creating employment opportunities in this extremely backward district of Uttar Pradesh.

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(Source: http://www.panoramio.com/photo/42198321)

(Source: http://sonebhadra.in/listings/88/)

NANOCABLE FOR NEW GENERATION ELECTRONICS APPLICATIONS

An artist's impression of Rice University's nanocable

(Source: http://news.rice.edu/2012/06/07/nanocable-could-be-big-boon-for-energy-storage/)

Researchers at Rice University, USA have created a coaxial cable like structure at the nanoscale, which they have christened "Nanocable". This nanocable has a diameter of 100 nanometers, which is a thousand times smaller than a human hair.

The discovery of the nanocable was serendipitous. Rice postdoctoral researcher Zheng Liu was trying to make pure copper wires covered with carbon using the Chemical Vapour Deposition (CVD) process. Zheng was coating copper with a single atom layer of a form of carbon called graphene, to use as interconnects in nanoelectronic devices. For his purposes, it was graphene that was of interest and the copper was just a structural support.

On testing the properties of the nanostructure fabricated, the research team found that a thin layer of copper oxide was forming between the copper and graphene. This reminded them of coaxial cables, where copper oxide serves as a dielectric layer. In a coaxial cable, the core is a solid copper wire that is surrounded by a thin sheath of insulating copper oxide. This is enclosed in another conducting layer of copper. In the case of the nanocable, the outermost layer is copper a thin layer of carbon measuring just a few atoms thick.

This similarity to the coaxial cable prompted the research team to name their creation as nanocable, and investigate its electrical and mechanical properties. They found that the capacitance of the nanocable was upto 143 microfarads per centimeter square, which is greater than any known metal–insulator–metal micro-capacitor. Moreover, this value is ten times greater than what is predicted by classical electrostatics, and explanations for this phenomenon have to be sought in the quantum mechanical realm. The Rice University team is excited at these findings.

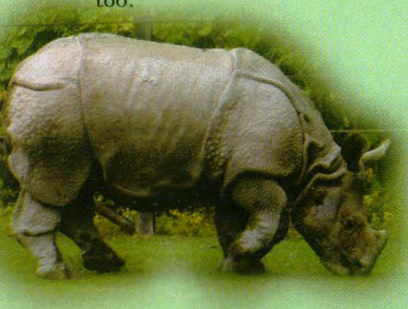
The nanocable could be used as a capacitor in miniature energy storage systems. Certainly, the most obvious use of the nanocable is analogous to the use of coaxial cable in electronics. Nanocable could be used in wiring up components of lab-on-a-chip processors. Zheng Liu also said that the nanocable could also be used as a transmission line for radio frequency signals at the nanoscale.

So the next time you observe an out-of-the-ordinary outcome of your experiment, look more closely and you may discover something exciting! The history of science is full of such instances of serendipity, where anomalies are observed and interrogated to open up completely new avenues of inquiry.

Adapted from: http://news.rice.edu/2012/06/07/nanocable-could-be-big-boon-for-energy-storage

MYTH OF THE RHINOCEROS URINE LIVES ON

In many parts of the world, in India too, people harbour the wrong notion that the urine of a Rhinoceros has a curative or medicinal value. This is a myth that has unfortunately spurred the demand for the rhino's urine. There are even websites that claim to sell unadulterated rhino urine. And there exists a black market for the rhino urine too.



Rhinoceros urine has long been considered in India to have medicinal properties. As late as 1984 when the rhinoceros translocation programme in Dudhwa was carried out, it was recorded that villagers in Dudhwa were asking for rhinoceros urine.

Even the British reaped economic benefits from this myth of the rhinoceros urine. During the British rule the Calcutta Zoological Gardens (Alipore Zoo) was probably the first zoo in the country that started the sale of rhinoceros urine to the public. Mr. James Leasor in his book *Boarding Party: The Last Action of the Calcutta Light Horse* says that in the 1930's during the period of financial depression, the government of Bengal was forced to cut the grant to the Calcutta zoological gardens. Due to the mounting expenses the Calcutta Zoo was almost on the verge of shutting down. At this critical period, Mr. Harry Squire, who happened to be one of the members of the honorary management committee, hit upon the idea of selling rhinoceros urine to the public. The keepers trained the rhinos to urinate into a bucket when they made a sound from a gong who were then rewarded with food. The collected urine was then bottled and put up for sale to the public.

Thereafter, the sale of rhinoceros urine became an important source of Calcutta Zoo's revenue but When the sale of rhino urine was banned in the year 1990, a bottle of rhino urine cost three rupees and fifty paisa. Like the Calcutta Zoo, the Delhi Zoo and the Guwahati zoo too sold rhinoceros urine.

Scientists have time and again categorically stated and reiterated that rhino urine has no medicinal use or value. It is only a myth just as the curative power of a rhinoceros horn is a myth. Sadly, myths have a habit of not dying.

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G. VENKATESH

Role of Consumers in Urban Water-Wastewater Systems

Sustainability would be like a tripod on two legs if its social aspects were ignored. This article describes the findings of an e-mail survey on what consumers feel could be their contribution in working towards sustainability of water-wastewater networks. Along with money, materials, machines and methods, customer cooperation emerged as a valuable resource in the study.

WATER is a basic human need. The indispensability of water and the sheer range of its usage make water conservation a necessity. Nations have gone to war over water in the past and may do so in the future if water resources are not wisely managed.

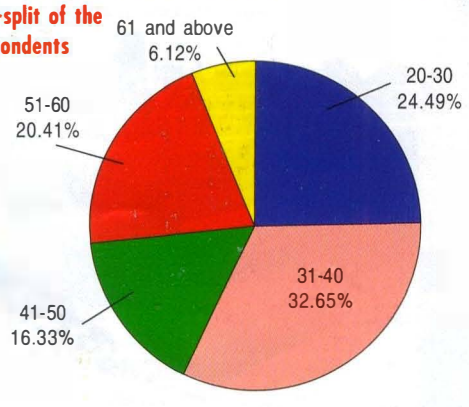
However, water is taken for granted by consumers who deem clean water access as their right. Most people are only vaguely aware of the consumption of energy and materials associated with water treatment, pumping and wastewater treatment downstream in urban water-wastewater networks. Energy consumption in the water-wastewater cycle indirectly contributes to global warming, while excessive materials consumption may lead to their quick depletion.

While water cuts are sources of ire and frustration, the challenges shouldered by the city and town authorities tend to go unheeded. Development of new water resources is investment-intensive, and so is the maintenance of pipelines in order to reduce leakages and thefts. To serve the people better, the municipalities are in need of more finances. Subsidies will not help for too long and loans from lending institutions are unaffordable most of the time. Raising the price of water for consumers will create unrest among the poor customers, which form a significant percentage of populations in cities of the developing world. People are not willing to pay more for services that they are used to receiving cheaply.

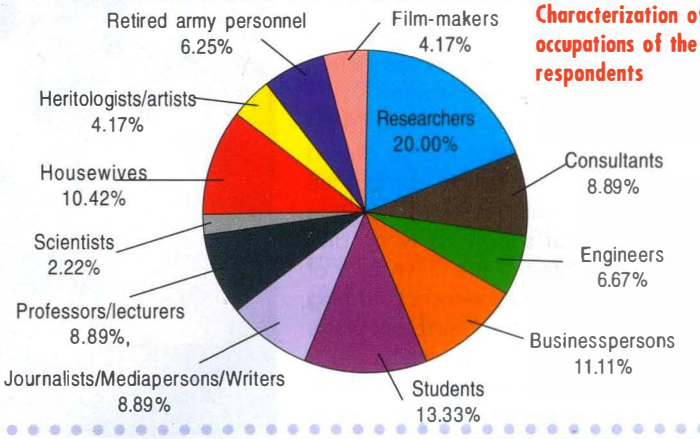
Thus, it behooves consumers to support cash-strapped municipalities by being willing to pay a little more and contribute to water conservation by taking reducing consumption, retrofitting the plumbing in their houses to accomplish reuse by cascade, harvesting rainwater etc. To understand what consumer attitudes and their potential role in water conservation, an e-mail survey of water consumers in Asia carried out.

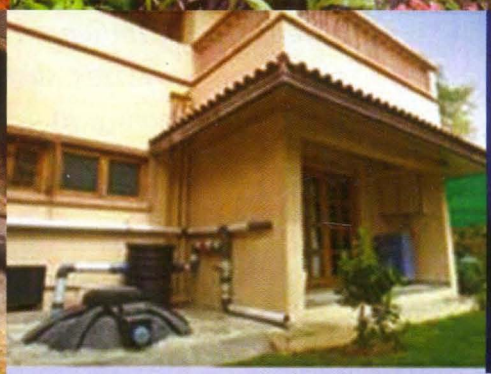
The cities included in the survey were Singapore, Vadodara, Mumbai, New Delhi, Kolkata, Jullundur, Noida, Gurgaon, Ahmedabad, Bangalore, Chongqing (China), Seoul (South Korea), and Tsukaba (Japan). Indians account for a significant percentage of the respondents, as not only were more of them contacted in the first place, but also a greater percentage of those contacted responded to the questionnaire. The male-female ratio among the respondents is 3:2. The figures below give more information about the respondent sample.

Age-split of the respondents



Characterization of occupations of the respondents





Clockwise from top left: Water scarcity is often a source of ire and frustration; Most respondents were not sure they would use laundry wash grey water for watering plants in the garden; Significant percentage of water consumed in households is used for flushing; Rainwater harvesting systems in housing societies are often associated with problems of cumbersomeness; Leakages constitute a major source of water loss.

Some of the queries posed to the respondents and their responses are given below.

If given an option, would you like to install a rain-tank on the roof of your house and use that water for laundry, toilet flushing etc.? If no, why not?

The reasons furnished by those who are unwilling or conditionally willing are the problems associated with obtaining the permission of fellow residents in high-rise buildings, cumbersomeness of installing a tank and associated plumbing, the suspect quality of the rainwater (e.g. its conduciveness to washing clothes) and the need to treat the same in-house before use, and the unreliability of rainfall.

It is interesting to note that despite the fact that the widespread motive behind setting up a water tank is to combat the unreliability of rainfall (that impacts the municipal water supply as well), one respondent pointed to the unreliability of rainfall as the main reason for not installing a water tank. What the municipal water supply collects in its reservoir is generally a fraction of the rainfall received by a city. In the monsoon region for example, there is a marked wet season, implying that there is almost no precipitation for the rest of the year. A rainwater tank may be active during the monsoon months when it can collect and store water. However, the use of rainwater for flushing alone, which consumes a great portion of household water consumption during the monsoon, would mean that the municipal reservoirs will not be depleted as quickly. The respondent from Japan believed that in his country, it would be preferable to have a tank on the ground instead of on the roof, to guard against typhoons.

In some Indian cities – Chennai for instance – it has been legally mandated that all new constructions be equipped with rainwater harvesting facilities (www.rainwaterharvesting.org). It was thought at the outset that all respondents

When water comes cheap strategies and devices to reduce water use fail (left)

Very few people give a thought to waste water treatment as a means to battling water scarcity (below)

from developing countries would support the idea of a rainwater harvesting tank. However, it turns out that quite a few people in India prefer to pass the onus to the city authorities and not take individual initiative.

Would you be keen on collecting water used in laundry wash and reusing that for other uses – like in the garden for instance?

While all respondents do not have their own gardens, the definition of 'garden' extends to potted plants in the balconies as well. Most respondents say that they will be willing to reuse the laundry wash grey water, though not necessarily to water plants in the garden. They say they would do so if they would know for sure that the detergents and soaps used for washing would not harm the plants. However, quite a few among them were keen on using the grey water for flushing, car washing and cleaning cemented areas around the house. A small percentage were fence sitters and not very sure of whether they would want to or not.

Of course, in order to make this reuse happen, one needs to retrofit the plumbing within the home to store the grey-water in a tank (and allow the excess to overflow into the municipal sewage mains). This was considered to be an obvious prerequisite, and hence not specified in the question. There are some who wrongly assume that what was being asked of them was to collect the grey water used for laundry in buckets and personally transport the same to the garden to water the plants. It turns out that some respondents, in cities plagued by water scarcity in India, have actually been collecting the wash-water (without soap) and using it to keep the potted plants in their balconies alive.

Have you ever wondered if it makes sense to use piped water (which is actually treated before supply) for flushing?

Some of the responses to the previous question indicated there were a few respondents who would not use grey water on their lawns or for gardening but would gladly reuse it for toilet flushing. A significant percentage of water consumed by households is used for flushing. A Hong Kong study estimates this use at around 30%, and this figure could be much more in lesser-developed cities of the world where uses such as car-washing, gardening etc. are low.

The motive behind the question was to find out if respondents had ever given a thought that clean water was being used for flushing, which could easily be done with recycled wastewater. Many respondents feared for the 'safety' of the toilet fittings or were put off by the additional effort and investment that redirecting the wastewater from the kitchen and bathroom would call for. A respondent from Japan considered that more than wastage of water, this implied wastage of energy and materials upstream and downstream. Over 80% of the energy consumption per unit of water consumed in households happens in treatment and pumping, according to a Taiwanese study. It is ironical that there are respondents who prioritise the fittings in the toilets over water and energy. Of course, while one respondent points out the potential harm that could be caused to the faucets and fittings, she also indicates that if the used water (grey, green or both) can be partially treated in-house, it can surely be used for flushing.

There are some cities in India where in addition to using rainwater tanks, people also draw groundwater from bore-wells to be used for flushing *inter alia*. However, this is not sustainable as a rapid depletion of ground water is not advisable. Thus, there are lock-ins, both at an institutional and structural level, as well as on a socio-psychological level, and breaking the mould is a difficult thing to do.

How keen are you on spending on water-saving devices? For instance, would you go out of your way to install sensor-controlled taps at your place (as a retrofit/replacement), in the absence of any regulations or compulsions from the authorities/government?

Water and energy-saving devices have forayed into the global marketplace. The latter are more in vogue considering the fact that energy is costlier than water. This question was aimed to gauge whether consumers, irrespective of whether water was pricey or cheap, would attempt to reduce their consumption by expending on installing water-saving devices. If water comes cheap, a cost-benefit analysis (CBA) based entirely on money spent and money saved, would suggest that such expenditures would not make economic sense. If not, this view would depend on whether the consumers are charged a flat rate every month or are charged on a per-unit-volume-consumed basis.

A respondent from China believed that personal will and water reuse in-house are more efficient means of reducing water consumption, than going in for hi-tech solutions. Over 30% respondents are of the view that installing water-saving devices will not really make much economic sense. This clearly points to the fact that when water comes cheap, any strategy to reduce use with unattractive cost is what most of the respondents focus on, either when refusing to install water-saving devices or when agreeing conditionally that this would be a good idea to reduce consumption.

In countries where water scarcity has never been a problem, the installation of flow-reducers in showers is primarily to reduce electricity consumption. The electricity consumption by the sensor in the taps is the stumbling block for one respondent from India – a clear indicator of the fact that energy is an economic good and water is still not considered to be one. Unfortunately, anyone furnishing this as the reason is oblivious of the fact that this sensor energy consumption is a very small fraction of the overall energy consumption along the entire cycle.

How much do you pay for water and wastewater services per month? Would you be happy to pay more if services need to be improved? Are you paying more now than you were paying before? Do you think water comes cheap in your city?

Among the respondents, most explicitly state that water is cheap in their cities. While few believe that it is reasonably priced, there are some who are even of the opinion that it is expensive. There is also a small fraction that is either unaware of the exact amount paid for water and sewage services or believes that water is for gratis. House rent or maintenance expenses paid every month often include water and sewage charges and the break-up is not generally known.

In some cities, where water is also purchased from private vendors in times of scarcity, the household expenses on water are double of what is paid to the municipalities. It is interesting to note that many respondents are willing to pay more 'if' services are bettered. This can be interpreted differently from paying more to help better the services. Of course, even in the developing countries, there are

INSIGHTS FROM THE SURVEY

- It is not reasonable to expect consumers to think about wastewater treatment and the environment when the water supply is not reliable and satisfactory.
- The chicken and egg situation exists when it comes to willingness to pay to improve services. It is often a case of 'will pay more if' and 'will pay more to'.
- Noble and innovative ideas occur to one and all, but the will to take the initiative is lacking.
- Life-cycle thinking, which enables one to understand indirect and long-term benefits, is very necessary if one needs to change the way one has been thinking, acting and reacting thus far.
- Water is cheap and therefore not given the same level of importance as, say electricity, which is metered and charged on a per-unit basis. Metering and raising the price of water would bring about a tremendous change in the way people perceive water in many parts of the world.
- Water-saving devices have not really made a significant impact in the global marketplace as much as energy-saving devices have. There is a market out there for innovative ideas to conserve and reuse water.
- Costs play a significant role in shaping decisions. If subsidies could be provided to promote the sale of devices and the adoption of technologies which would result in optimising the use of water, till such a time that these entrench themselves in the marketplace, changes for the better can happen relatively faster.

individuals – generally the senior citizens – who are willing to contribute in any way they can to facilitate water conservation. One respondent was willing to pay more if the adverse environmental impacts related to wastewater discharges and water depletion could be alleviated. This is noteworthy as, unlike most people, who would wish to pay more for betterment of services – interpreted as reliable supply of cleaner water – the driving force behind willingness to pay can also be the environment. On the other hand, there are those who say that unless the benefits obtained by paying more are direct and conspicuous, true willingness is difficult to come about.

In India for instance, the payments have been very much the same for many years now, while in many other countries like Japan and China for instance, it is gathered that the payments are gradually increasing, as the level of water and wastewater treatment has also improved over time. A respondent from Singapore, while not very sure of how much he paid per month for water and sewage services, believed that if permission to install rainwater tanks could be obtained easily, citizens of his country might end up paying less than whatever they were paying at present.

Are you happy with the water and wastewater services provided by the authorities in your city? Do you ever think about the need for wastewater treatment before disposal, as much as you think about the reliability of water supply?

Whether one is affluent or otherwise does not really influence opinions much, when one talks about a common problem like water scarcity, which afflicts one and all. Private vendors do exist and the rich may be able to afford the highly-priced water on the private market for some time, but certainly not for too long a period of time. It is only when water availability is guaranteed and the quality of water supplied does not leave any room for dissatisfaction, that consumers spare a thought for the environment.

While most respondents have given a thought to wastewater treatment (even in the developing world where this is usually accorded a much lower priority), one respondent was of the opinion that the wastewater need not be treated if it is not going to be reused in some way. This indicates either ignorance or neglect of the sink into which the wastewater flows, and the concomitant problems like eutrophication etc. One respondent from the developed world was not aware of what wastewater treatment actually entails. The Singaporean is happy with the services, but worries about reliability considering that his country imports water from Malaysia.

Ear to the Ground

Knowing what people think and are willing to do is just a first step. It is of course much better than totally abstaining from attempting to find out what their needs, opinions, demands and complaints are. Management must come down to the ground and decide on things after knowing the realities. Capacity building in sustainable urban water management includes mobilising community support. Governments which have sustainable development on their agenda need the support of the people to accomplish steady economic growth without compromising environmental upkeep.

However, merely knowing what people think does not yield a silver bullet solution to the challenges faced by society and government. Often, public policy is aimed at satisfying the majority even if that would annoy the minority. There is sadly no perfect via media. A referendum however is a very good starting point. Misgivings, non-cooperation and suspicions can be healed if one can ascertain that they exist. Capacity building in sustainable urban water management includes mobilising community support.

Governments that have sustainable development on their agenda need the support of the people to accomplish steady economic growth without compromising environmental upkeep. Knowing what people think and are willing to do is just the first step in water conservation. Misgivings, non-cooperation and suspicions can be healed if one can ascertain that they exist. Water resource management authorities must come down to the ground and implement plans after knowing these realities.

However, merely knowing what people think does not yield a silver bullet solution to the challenges faced by society and government. Often, public policy is aimed at satisfying the majority even if that would annoy the minority. A referendum however is a good starting point.

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The last date for receiving the entries is 15 October 2012.

AWAKASH SONI

HORMONE QUIZ

1. **Branch of science that deals with the study of endocrine glands and their secretion:**
   a) Endocrinology b) Cryobiology
   c) Entomology d) Angiology

2. **Who is the father of endocrinology?**
   a) T. Addison b) Beylis & Starling
   c) Canon d) A. S. Shafer

3. **Earliest known hormone was ... :**
   a) Glucagon b) Insulin
   c) Secretin d) Thyroxin

4. **Name of the hormone that was first recognized by its name:**
   a) Thyroxin b) Insulin
   c) Inhibin d) Secretin

5. **Term hormone was coined by:**
   a) T. Addison b) Sandstum
   c) Beylis & Starling d) Abel

6. **Hormones are generally not stored in body but a stored hormone is:**
   a) Insulin b) Testosterone
   c) Thyroxin d) Secretin

7. **Hormones that work against each other are called:**
   a) Synergistic b) Antagonistic
   c) Local hormone d) None of these

8. **Hormone that is responsible for lactation (production of milk in mammary glands):**
   a) Oxytosin b) Estrogen
   c) Prolactin d) Progesterone

9. **Hormone that causes ejection of milk from mammary gland:**
   a) Prolactin
   b) Oxytosin
   c) HCG (Human Choreonic Gonadotropin)
   d) Progesterone

10. **Hormone that stimulates and controls metamorphosis in larva of amphibians:**
    a) Thyroxin b) Parathyroid hormone
    c) Thyarocalcitonin d) Inhibin

11. **Hyposecretion of which hormone causes cretinism (retarded growth, undeveloped sex organ):**
    a) Parathyroid hormone b) Thyroxin
    c) Thyarocalcitonin d) Prolactin

12. **Electrolyte balance in body is maintained by:**
    a) Mineralocorticoid b) Glucocoticoid
    c) Epinephrine d) Norepinephrine

13. **Which of the following decreases blood sugar level:**
    a) Glucagon b) Insulin
    c) Somatostatin d) None

14. **Spermatogenesis is initiated by:**
    a) Testosterone
    b) FSH (Follicle Stimulating Hormone)
    c) Inhibln
    d) Enterokinine

15. **Pregnancy hormone is ...**
    a) Leutinising hormone
    b) Relaxin
    c) Progesterone
    d) FSH (Follicle Stimulating Hormone)

16. **Pregnancy test is confirmed by the presence of which hormone in urine:**
    a) Progesterone
    b) FSH (Follicle Stimulating Hormone)
    c) HCG (Human Choreonic Gonadotropin)
    d) Relaxin

17. **Hormone that regulates Erythropoeisis (production of RBCs):**
    a) Renin hormone b) Secretin
    c) Inhibine d) Enterokinine

18. **According to recent view Pineal body is:**
    a) Organ of memory
    b) Organ of involuntary action
    c) Vestigial organ
    d) Endocrine organ & avoid ageing

19. **The word 'hormone' means:**
    a) To move b) To excite
    c) To set in motion d) To increase

20. **Which one of the following disease results from endocrine disorder?**
    a) Pneumonia b) Goiter
    c) Jaundice d) Typhoid

ANSWERS:

1) a	2) a	3) c	4) d	5) c	6) c	7) b	8) c
9) b	10) a	11) b	12) a	13) b	14) b	15) c	16) c
17) a	18) d	19) c	20) b				

Contributed by Shri Awakash Soni, Division of Parasitology, Central Drug Research Institute (CDRI), Chhattar Manzil Palace, Lucknow (U.P.); E-mail: awakash.sara07@gmail.com

HEMEN HAZARIKA

INFORMATION TECHNOLOGY

1. **Which famous corporate get its name from a brute race mentioned in Jonathan Swift's novel "Guliver's Travels"?**
   a) Sify b) Google
   c) Intel d) Yahoo

2. **Who designed the famous logo of Sun Microsystems, which can be read from all four directions?**
   a) Dr Raghuveer Anand b) Prof Samuel Hurst
   c) Rochy Maqbul d) Prof Vaughan Pratt

3. **Name the personality who founded Digital Equipment Corporation (DEC) in 1957, which developed the first minicomputer, the PDP-8:**
   a) Ken Olsen b) Wright Oke
   c) Smith Bushnell d) Tom Cruise

4. **Which day is celebrated as Computer Literacy Day?**
   a) 1st August b) 3rd July
   c) 4th November d) 2nd December

5. **Full form of psychiatric disorder "MAIDS"**
   a) Mobility And Information Driving System
   b) Mobile And Input Diskette Solution
   c) Mobile And internet Dependency Syndrome
   d) Mobile and Internet Dwelling Software

6. **Name the technology that is named after the King of Denmark and Norway in the 10th century:**
   a) Wi-Fi b) 3D
   c) PictBridge d) Blue-tooth

7. **Most LINUX distros and programs follow something called the KISS principle. What is it?**
   a) Kind In Show and Service b) Keep in Side Side
   c) Keep it Simple Stupid d) Korn In Soft System

8. **"Hardware costs reduce by 33% every year." This statement is famous as:**
   a) Brad's law b) Rana's rule
   c) Moore's law d) Law of Hardy

9. **Who in 1953 said, "I think there is world market for may be five computers"?**
   a) Thomas Watson b) Bill Gates
   c) Vinod Dham d) James Teen

10. **What is the virus called that attacks Antivirus and hides their detection?**
    a) Dengue Virus b) Retro-Virus
    c) Trim Virus d) Nony Virus

11. **The first country to have e-parliament where people meet virtually is:**
    a) Japan b) Malaysia
    c) India d) Singapore

12. **Famous international company in whose advertisement Mahatma Gandhi was shown?**
    a) Dell b) Toshiba
    c) Apple Computers d) Microsoft

13. **What is the fear of Internet called?**
    a) Interophobia b) Abusophobia
    c) Anoraknophobia d) Retrophobia

14. **"Rupbahini" is the TV network of which South Asian Country?**
    a) Bhutan b) Sri Lanka
    c) Pakistan d) Myanmar

15. **Sci-Fi Anime released in 2007 was based on?**
    a) Interspace b) Speed
    c) Second Life d) Politics

16. **In Internet chatting terminology, TOY means?**
    a) Thinking Of You b) To Offer You
    c) Thought Of Yesterday d) Talk Of Young

17. **The name of Penguin mascot used for LINUX operating system?**
    a) Pengu b) Cuty
    c) Tux d) Linus

18. **Developer of first "touch sensor" in 1971?**
    a) Dr Sam Hurst b) Robert Philip
    c) Klim Hegde d) Prit Roddik

19. **Time Man of the year 1982?**
    a) Paul Allen b) Personal Computer (PC)
    c) Pentium Chips d) Games Gosling

20. **Which Bollywood star launched the cellphone game "Velocity" with Small Device Company?**
    a) Aamir Khan b) John Abraham
    c) Abhishek Bacchan d) Milind Soman

ANSWERS:

1. d	2. d	3. a	4. d	5. c	6. d	7. c	8. c
9. a	10. b	11. d	12. c	13. a	14. b	15. c	16. a
17. c	18. a	19. b	20. b				

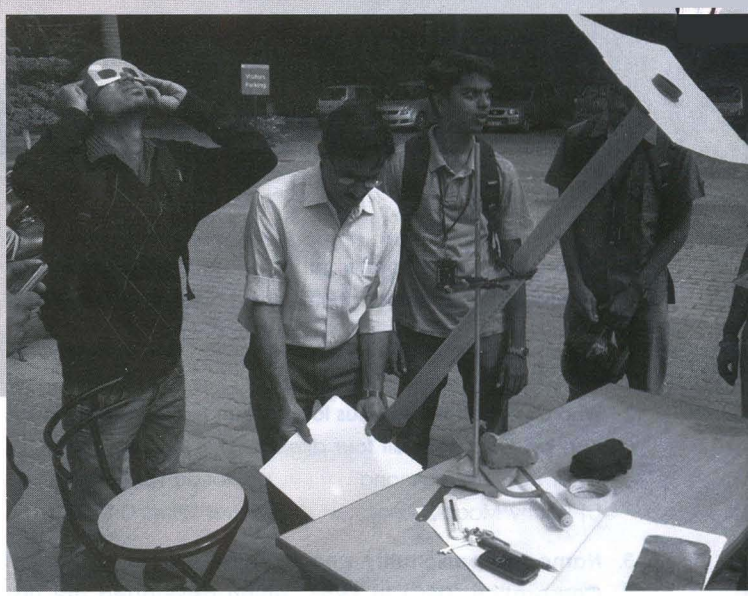
Contributed by Shri Hemen Hazarika, Vill. Nalisha, PO Jagara, Distt Nalbari, Assam-781310

SHORT FEATURE

Venus Transit 2012

Finding the Diameter of Venus

RAVEESHA K.H. AND KAMAL KUMAR



Students observing the Venus transit

WE observed this century's last Venus transit from our Institute (CMR Institute of Technology) on 6 June 2012 from 7 am to 10 am by projecting the sun's image from a refractor telescope on to a screen. Though intermittent clouds affected our viewing, we could get glimpses of the transit once in a while.

We thought of using this observation to find the diameter of Venus. Here is how we did it:

Setting up the Apparatus

We assembled the refractor telescope using the following specifications:

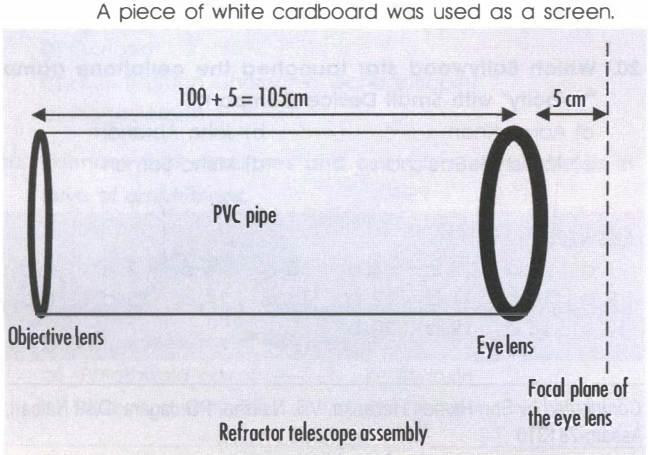
(a) Lens

- Convex lens of Large Focal length (100 cm) – acts as an Objective lens
- Convex lens of small Focal length (5 cm) – acts as an Eye Lens

(b) PVC pipe

- Diameter: Equal to the diameter of the lens – Generally 2 inch
- Length: Equal to the sum of the focal lengths of the two lenses (100+5 =105 cm in this case)

A piece of white cardboard was used as a screen.



Finding the Diameter of Venus

The objective lens of the telescope was turned towards the sun and the screen was placed behind the eye lens such that the image of the sun was projected on it. If the screen is not held properly, the image will be distorted. The screen may be moved backwards to obtain a bigger image.

Venus appeared as a black spot on the sun's image. We accurately measured the diameter of the image of Venus (d) and the distance of the screen from the focal plane of the eye lens (X) (not from the eye lens). The diameter of Venus was found by using the formula:

Diameter of the Venus $D = \frac{S.d}{X.m}$ metres

Here M is the magnification of the telescope (100/5=20 in our case)

S is the Earth-Venus distance = 420 x10^8 metres

Our Data

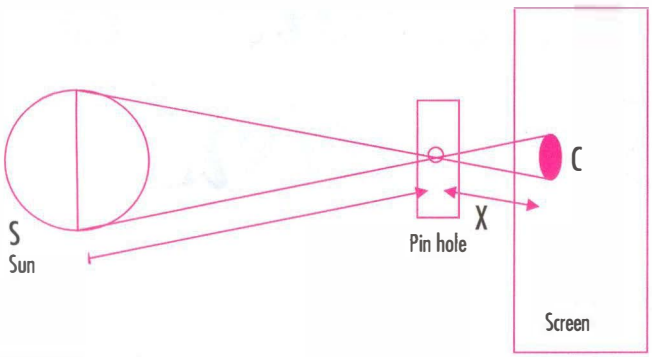
The screen was kept at a distance of around 26.5 cm (0.265 m) from the focal plane of the eye lens. The diameter of the image of Venus appearing as a black dot was approximately 1.5 millimetre (0.0015m):

Diameter of Venus = The actual diameter of Venus found from the best techniques is found to be 12056 km.

$$\frac{S.d}{X.m} = \frac{420 \times 10^8 \times 0.0015}{0.265 \times 20} = 11886.792 \text{ Km} = 11886792 \text{ m}$$

Although the formula used above is not generally quoted in all the books, experts say that it can be easily derived from the first principles. We have also used this formula to find the diameter of the sun and obtained correct results. This is only an extension of the expression used in the pin-hole camera method.Pin hole

Principle of the Pin-hole Camera

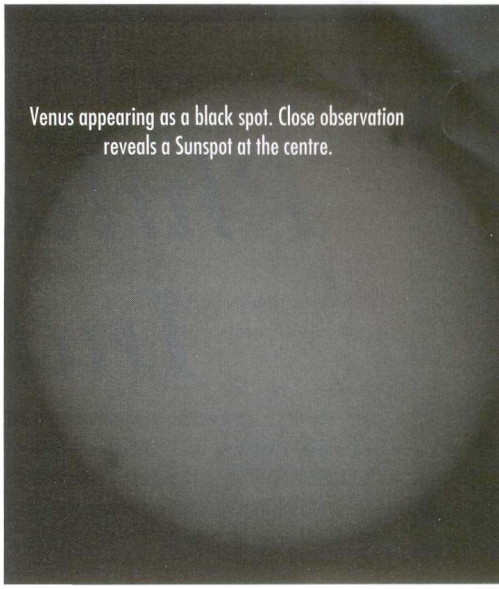


From geometry, we can say, $\frac{D}{d} = \frac{S}{X}$

When we use a telescope instead of a pin-hole set up, to get the proper diameter of Sun, we found that X in the above expression has to represent the distance from the focal plane of eye lens to the screen. Also to compensate for the magnification by the telescope, the magnification factor M has to find a place in the above formula. So by trial and error method, we realized that the expression

$D = \frac{Sd}{XM}$ works.

If the screen is not held properly, the image will be distorted. The screen may be moved backwards to obtain a bigger image. Venus appeared as a black spot on the sun's image.


Venus appearing as a black spot. Close observation reveals a Sunspot at the centre.

Finally, remember to always use a screen to view eclipses. Watching the sun with naked eye or telescope can cause serious damage to your eyes.

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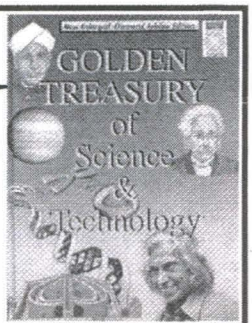

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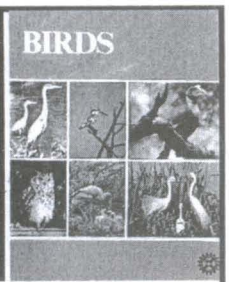

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Philatelic Tribute to Indian Scientists

SEEMIN RUBAB

Innumerable postage stamps have been issued over the years depicting scientists and their contributions and also institutions of excellence they helped set up or that were named after them. All of which the country could be truly proud of. Exciting stories can be woven around many scientific themes using these postal stamps.

THE announcement of the discovery of the Higgs boson created a bang recently. The fact that one of the most remarkable scientific discoveries in recent times had an Indian name associated with it – 'boson' – was indeed heart warming. But how many of us really know which of the two scientists the term relates to – Jagadis Chandra Bose or Satyendranath Bose? Well, 'boson' was named in recognition of Satyendranath Bose's significant contribution to quantum mechanics. Jagadis Chandra Bose, on the other hand, pioneered the investigation of radio and microwave optics, and was even named by IEEE as one of the fathers of radio science.

Newly independent India was privileged to have Homi Jahangir Bhabha, P.C. Mahalanobis, S.S. Bhatnagar, Birbal Sahni, Vikram Sarabhai and many others who were not only great scientists but also remarkable visionaries and institution builders. It is a pity that Indian masses in general and students in particular are hardly aware about the achievements of Indian scientists. It is one of the recommendations of the National Knowledge Commission to launch a massive science outreach and extension programme.

Biographies of scientists have great motivating values for youngsters. Acharya P.C. Ray became interested in science after reading Benjamin Franklin's biography and his famous Kite experiment. Biographies of Indian scientists should be an integral part of the school curriculum.

Biographies may also be supplemented with stamps instead of usual photographs as stamps carry additional information. For example, if one looks at a stamp brought out to honour Meghnad Saha, it becomes obvious that he specialized in astrophysics. Vikram Sarabhai was a space pioneer is evident from his stamps. That S.S. Bhatnagar, Homi Bhabha and P.C. Mahalanobis were institution builders is testified by the buildings depicted in the background in the postage stamps brought out to honour them.

Postage stamps, due to the visual appeal they carry, can offer a very good medium to communicate science in an interesting and creative manner. Innumerable postage stamps have been issued over the years depicting scientists and their contributions and also institutions of excellence they helped set up or that were named after them. All of which the country could be truly proud of. Exciting stories can be woven around many scientific themes using these postal stamps. These stories can be communicated through the print medium, audiovisual medium such as PowerPoint presentations or even through documentaries.

It cannot be denied that the process of communication of ideas becomes more delightful through visuals depicted on stamps and brief write-ups. Famous Physicist Ernest Rutherford had aptly said: 'All science is either physics or stamp collecting'.

Here is a random collection of stamps depicting some renowned Indian scientists, their contributions to Indian science and the institutions they helped build. As one can see, a collection of stamps could be linked up and used to tell exciting stories about Indian science that could motivate today's youngsters.

With endowments from J.R.D. Tata, Bhabha established the Tata Institute of Fundamental Research in 1945. The TIFR is recognized by the Government of India as the National Centre for Nuclear Science and Mathematics.

S.N. Bose

Satyendra Nath Bose was a physicist, specializing in mathematical physics and has been in the news recently after the discovery of the Higgs boson was announced. He is best known for his work on quantum mechanics providing the foundation for Bose-Einstein statistics and the theory of the Bose-Einstein condensate. A group of particles obeying Bose Einstein statistics are known as Bosons. Bosons are like Indians, accommodating and friendly. Many Bosons can live together as opposed to Fermions, which are a group of particles preferring to live alone. The S.N. Bose National Centre for Basic Sciences is an autonomous research institute under the Department of Science and Technology, Government of India, established in 1986 to honour S.N. Bose.

Homi Jehangir Bhabha

Homi Jehangir Bhabha was a nuclear physicist who played a major role in the development of the Indian atomic energy programme and is considered to be the father of India's nuclear programme. After his death, the Atomic Energy Establishment was renamed as the Bhabha Atomic Research Centre in his honour. Bhabha also encouraged research in electronics, space science, radio astronomy and microbiology.

TIFR

With endowments from J.R.D. Tata, Bhabha established the Tata Institute of Fundamental Research in 1945. The TIFR is recognized by the Government of India as the National Centre for Nuclear Science and Mathematics. Other noted institutions in his name are the Homi Bhabha National Institute, a deemed university and the Homi Bhabha Centre for Science Education, Mumbai.

Radio Telescope, Ooty

The famed radio telescope at Ooty was Bhabha's initiative and it became a reality

in 1970. This telescope is in the form of a parabolic cylinder and operates at 327 MHz. It is one of the largest telescopes in the world operating at meter wavelength. The concept, design and fabrication of this telescope are indigenous. It is operated by the TIFR.

Indian Institute of Science

The Indian Institute of Science (IISc) was conceived by Jamsetji Nusserwanji Tata, in the final years of the 19th century and finally set up on 27 May 1909. The stamp above shows several eminent dignitaries of the time including the founder J.N. Tata, Swami Vivekananda, whom J.N. Tata befriended on his famous voyage to the United States, Dr Bhabha who established the cosmic ray research unit at the IISc, Nobel laureate C.V. Raman who headed the unit, the Maharaja of Mysore, Shri Krishnaraja Wodeyar IV, and Lord Curzon, the Viceroy of India, whose first task on arrival on 31 December 1898 was to receive a draft proposal prepared by the Provisional Committee set up to plan the establishment of the Institute. The stamp was released at the centenary of the IISc.

Dr S.S. Bhatnagar and NPL

Dr Shanti Swarup Bhatnagar, who founded the Council of Scientific & Industrial Research (CSIR), is seen in the backdrop of the National Physical Laboratory (NPL), a premier laboratory in the field of Physical Sciences and one of the many laboratories of CSIR scattered throughout the country. Bhatnagar's research

interests included emulsions, colloids, and industrial chemistry, but his fundamental contributions were in the field of magneto-chemistry. Jointly with K.N. Mathur, Dr Bhatnagar invented an

Dr S. S. Bhatnagar became the first director-general of the CSIR. He established a total of 12 national research laboratories in India.CSIR established the Shanti Swaroop Bhatnagar Prize for honouring young scientists.

instrument called the Bhatnagar-Mathur Magnetic Interference Balance. The balance was one of the most sensitive instruments for measuring magnetic properties.

He became the first Director-General of the CSIR. He established a total of 12 national laboratories such as the Central Food Technological Research Institute (Mysore), National Chemical Laboratory (Pune), National Physical Laboratory (New Delhi), National Metallurgical Laboratory (Jamshedpur), and Central Fuel Research Institute (Dhanbad), just to name a few. After his death, CSIR established the Shanti Swaroop Bhatnagar Prize for honouring young scientists.

Council of Scientific and Industrial Research

The Council of Scientific and Industrial Research (CSIR) was set up under the chairmanship of Dr. Bhatnagar in 1942 with

the primary objective of advancement of scientific knowledge and sustained industrial development of the country. Over the years, CSIR has developed into one of the largest chains of laboratories around the world – it is today a well knit and action-oriented network of 38 laboratories spread throughout the country with activities ranging from molecular biology to mining, medicinal plants to mechanical engineering, mathematical modelling to metrology, chemicals to coal and so on.

Indian Statistical Institute and P.C. Mahalanobis

Professor P.C. Mahalnobis was the pioneer of statistical methods in India. Basically a physicist, he was introduced to statistics by W.H. Macaulay through Biometric tables. The most prestigious institute of statistics in

India is the Indian Statistical Institute founded by none other than Prof. Mahalanobis in Kolkata. He contributed to Anthropometric studies in India. His most important contributions are related to large scale sample surveys. He introduced the concept of pilot surveys and advocated the usefulness of sampling methods. Mahalanobis was a member of the planning commission and contributed immensely to the second five-year plan.

Vikram A. Sarabhai

Vikram Ambalal Sarabhai was also a physicist. He is considered to be the father

of the Indian space programme. Vikram Sarabhai founded the Physical Research Laboratory in Ahmedabad. The establishment of the Indian Space Research Organization (ISRO) was one of his greatest achievements. Dr. Sarabhai was also a pioneer in science communication; he founded a Community Science Centre at Ahmedabad.

Sir J.C. Bose

Sir Jagadis Chandra Bose, was an outstanding polymath: a physicist, biologist, botanist, archaeologist, as well as an early writer of science fiction. He pioneered the investigation of radio and microwave optics, made very significant contributions to plant science, and laid the foundations of experimental science in the Indian subcontinent. IEEE named him as one of the fathers of radio science. He was far ahead of his time. He had an American patent at a time when the majority of people in the subcontinent were unaware of either the term or its significance. Sir

Sir JC Bose, was an outstanding polymath: a physicist, biologist, botanist, archaeologist, and a writer of science fiction.

J.C. Bose founded the Bose Institute in 1917. Bose Institute is a premier research institute in the fields of Physics, Chemistry, Botany, Microbiology, Biochemistry, Biophysics, Plant Molecular and Cellular Genetics, Animal physiology, Immunotechnology and Environmental science.

Sir C.V. Raman

Sir Chandrasekhara Venkata Raman was a Nobel laureate in physics recognized for his work on the molecular scattering of light and for the discovery of the Raman effect.

Raman made significant contributions to the quantum photon spin, acousto-optic effect, and acoustics of Indian musical instruments. We celebrate the National Science Day on 28 February every year to commemorate the discovery of the Raman effect in 1928. After two years of this discovery, Sir C.V. Raman brought the first Nobel Award for the country in 1930. Raman Effect has continuously impacted every field of science. Researchers across the world are still extracting exciting new results from his discoveries. Its role in spectroscopy, medical diagnostics and material characterization had been phenomenal.

Meghnad Saha

Meghnad Saha was an astrophysicist best known for his development of the Saha equation, used to describe chemical and physical conditions in stars. Saha and S.N. Bose proposed an equation of state for real gases. Prof. Saha founded the Institute

Saha and S.N. Bose proposed an equation of state for real gases.

of Nuclear Physics in 1950, which was inaugurated by Nobel laureate Irene Joliot-Curie to initiate research in Nuclear Physics. The institute later diversified its research areas and was renamed as the Saha Institute of Nuclear Physics.

D.D. Kosambi

Damodar Dharmananda Kosambi was a mathematician, statistician, historian, and

polymath who contributed to genetics by introducing Kosambi's map function. He is well known for his work in numismatics and was also a Marxist historian specializing in ancient India.

D.N. Wadia

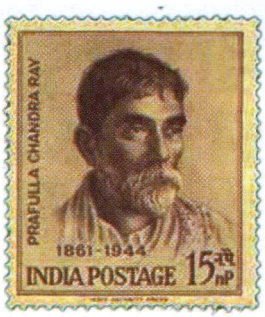
Darashaw Nosherwan Wadia was a geologist working for the Geological Survey of India. He helped establish geological studies and investigations in India including the Institute of Himalayan Geology in Dehradun, which was later

S. Chandrasekhar was an Indian American astrophysicist. His bust is shown on the first day cover along with Bhabha and S.N. Bose to commemorate the International Year of Physics in 2005.

renamed the Wadia Instituate of Himalayan Geology.

Acharya P.C. Ray

Acharya Prafulla Chandra Ray was an academician, a chemist and an entrepreneur. In fact he was among the first techno-entrepreneurs of India. He was



Acharya Ray was among the first techno-entrepreneurs of India.

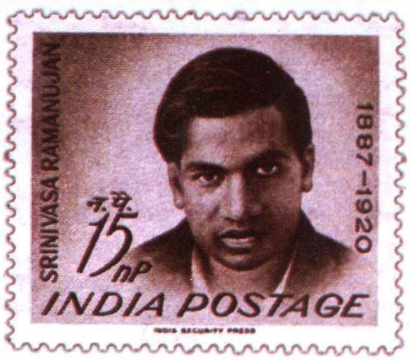
the founder of Bengal Chemicals & Pharmaceuticals, India's first pharmaceutical company. He was a contemporary and friend of Sir J.C. Bose.

International Year of Physics

Subrahmanyan Chandrasekhar was an Indian American astrophysicist. His bust is shown on the first day cover along with Bhabha and S.N. Bose to commemorate the International Year of Physics in 2005. He was a Nobel laureate in physics along with William Alfred Fowler for their work in the theoretical structure and evolution of stars. The Chandrasekhar limit is named after him. Chandrasekhar was the nephew of Sir C.V. Raman.

S. Ramanujan

Ramanujan was one of the greatest Indian mathematicians. He was a self-taught person. He is known for the Ramanujan prime and Ramanujan theta function. He



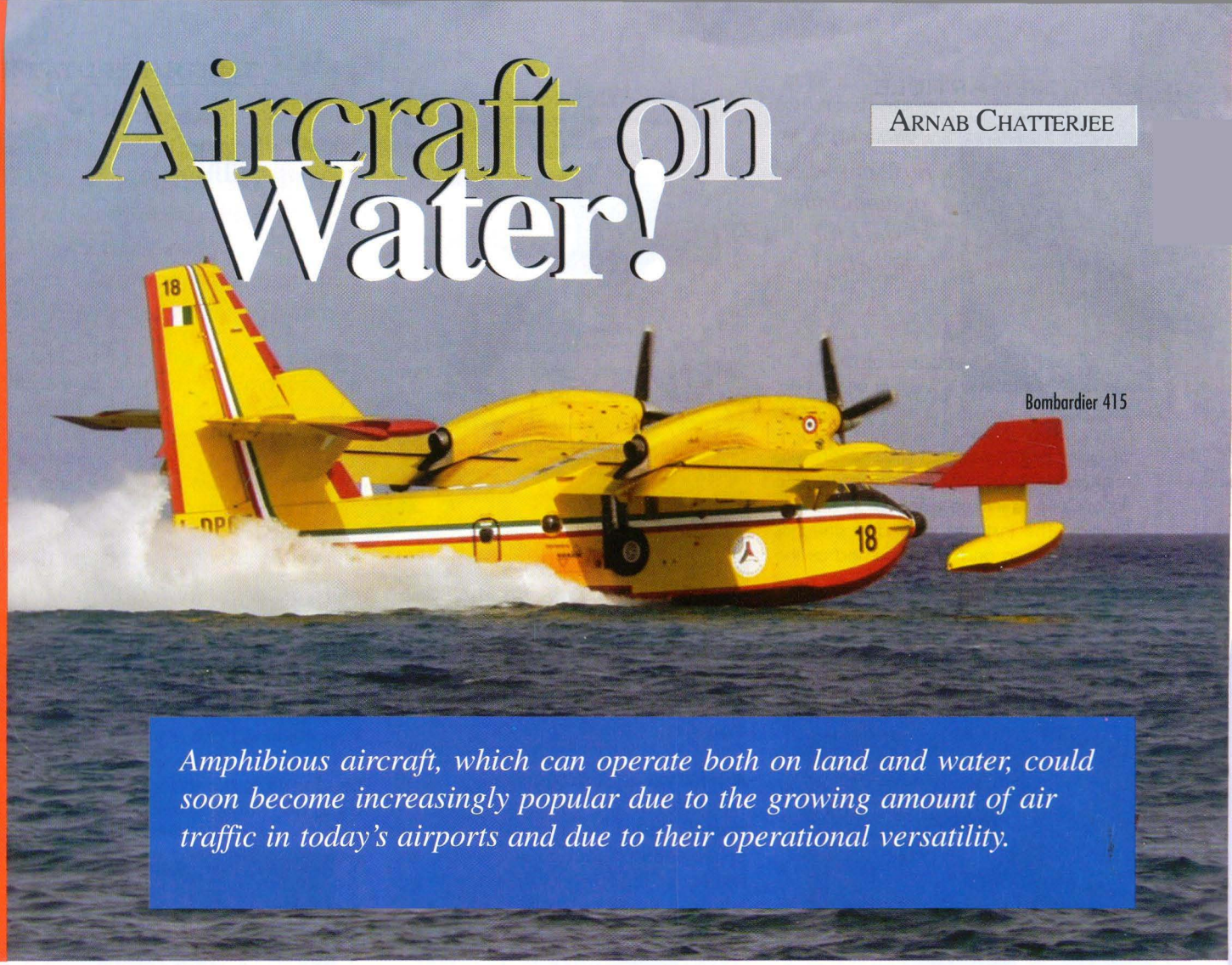
Ramanujan made substantial contributions to mathematical analysis etc.

made substantial contributions to mathematical analysis, number theory, infinite series and continued fractions. Ramanujan's work has profound significance in physics as well. His formulas have applications in crystallography and string theory.

Dr Seemin Rubab, a doctorate in Renewable Energy from IIT Delhi, teaches Physics at the National Institute of Technology, Srinagar. She is an avid philatelist and has won gold medals at state level philatelic competitions. Address: AP, Physics, NIT Srinagar, Jammu and Kashmir-190006; Email: ask_rubab@yahoo.co.in

Aircraft on Water!

ARNAB CHATTERJEE



Bombardier 415

Amphibious aircraft, which can operate both on land and water, could soon become increasingly popular due to the growing amount of air traffic in today's airports and due to their operational versatility.

IT has been 108 years since the first aircraft took off for a 12-second flight from the field of Kitty-Hawk, Northern Carolina, USA on 17 December 1903. It was the Wright Flyer I built by the Wright Brothers, Wilbur and Orville Wright. It ushered in an era of airplanes and gave an entirely new dimension to the then field of aeronautics (previously aeronautical tests and experiments were mainly done on hot air balloons).

As years passed, aircrafts grew in size, operational range and carrying capacity. New dimensions of design were born which enabled aircrafts to cross the speed of sound (768 mph/1235 km/h). Operational capabilities of aircrafts were enhanced and aircrafts are now operating in all weather conditions (except in highly adverse conditions) and in all regions of the world. Aircrafts are also now operational not only from land but also from water (seaplanes). Today, we also have amphibious aircrafts (coming from the word 'amphibian') that are able to operate from both conventional runways on land and from water bodies as well.

The development of amphibious aircrafts can be traced back to the invention of seaplanes. The first powered hydroplane that took off from water on 28 March 1910 in Martigues, France was flown by French aviator Henri Fabre. According to US records, the first citizen to fly a seaplane in the US was Glenn Hammond Curtiss on 26 January 1911, the founding father of The Curtiss Aeroplane and Motor Company. His airplane had floats or pontoons attached to its undercarriage which helped it to land and takeoff from water.

Although these were among the first powered seaplanes, drawings and designs of amphibious flying machines and vehicles could be traced back to the early years of the 19th century. Seaplanes, mainly flying boats, saw extensive action in the Second World War. Notable aircrafts like *Short Sunderland* (serving the Royal Air Force), *Kawanishi 8HK* (serving the Imperial Japanese Navy, termed as the fastest flying boat of World War II) and the amphibious bomber aircraft *Consolidated PBY Catalina* (primarily serving the United States Navy) mainly conducted anti-submarine warfare and torpedo bombing caused great losses to the enemy especially their navy and submarines. The main factor that led to their success was their versatility in operating and landing on water, while other land-based anti-submarine aircraft had to take off from their bases far away from the coast thus consuming more fuel and precious time.

Since then, with increasing advancements in the field of aeronautics, amphibious aircraft designs also changed. Amphibious aircrafts built by The Cessna Aircraft Corporation and Bombardier Aerospace Corporation are today becoming popular. The harsh terrains of Alaska and Canada are primarily dependent on seaplanes and amphibious aircrafts for transporting passengers and

In the future, amphibious aircrafts would become increasingly popular due to the growing amount of air traffic in today's airports

cargo to the remotest parts of their territory where construction of runways and airports are virtually impossible.

Based on the design and construction of amphibious aircrafts, they can be broadly categorized into two types: the flying boat type and the floatplane type.

Flying boat type: These are the most common types of heavy amphibious aircraft seen today. They have a specially designed and strengthened fuselage that acts like the hull of a ship and thus helps the aircraft to takeoff and land on water. They generally have a high wing configuration with respect to their fuselage with engines mounted on them to prevent them from being sprayed by water during takeoff or landing. The retractable landing gear is commonly housed within the fuselage that is retracted when landing on a runway.

Very often, the flying boat type being larger and longer in size has retractable under wing floats that provide additional stability to the aircraft while taxiing, taking-off or landing on water. These under wing floats often are used to store additional fuel for the aircraft (just like the external drop tanks of conventional military aircraft). An excellent example of this type is the *Consolidated PBY Catalina*. Another example of an amphibious aircraft of the flying boat type currently in service is the *Bombardier 415*.

Floatplane type: Very few heavy amphibious aircraft are of the floatplane type. They are generally cheaper and lighter than the flying boat type. Mainly used for private transport and for transportation of a limited number of people and cargo, they are preferred in mountainous terrains due to their small size. Their landing gears are incorporated into their floats while the rest of the aircraft features are similar to that of a conventional land based aircraft. The design of floatplanes is however more aerodynamic compared to the flying boat type aircraft.

The only problem faced by floatplanes is their large floats, which add extra drag to the aircraft thus rendering

Drawings and designs of amphibious flying machines and vehicles could be traced back to the early years of the 19th century. Seaplanes, mainly flying boats, saw extensive action in the Second World War.

generally attached to the fuselage centerline and two under wing floats. The fuselage centerline being one of the strongest parts of the aircraft gives it the ability to land on rough seas; however, the double float-versions exhibit quite a lot of ease while mooring and boarding on calm water but they are not able to tackle the rough seas. The dual float also leaves it belly open for carrying of additional payload like torpedoes or bombs (in a military floatplane) or extra fuel in drop tanks.

The Jet Age

With the advent of the jet age, aircraft designs were made more aerodynamic and the range and carrying capacity of the aircraft increased considerably. Aerospace engineers came up with the idea of developing an all turbojet/turbofan powered amphibious aircraft. Currently the largest amphibious aircraft in service is the jet powered *Beriev A-40* (NATO reporting name: Mermaid), built by The Beriev Aircraft Company of Russia. It has a length of 47 metres and a wingspan of 42.5 metres and a maximum takeoff capacity of 86000 kg. The aircraft is being primarily used by the Russian Naval Aviation.

Another notable aircraft built by The Beriev Aircraft Corporation is the Beriev Be-200. These aircrafts are being used mainly for transportation and for fire fighting. However there are not many variants of jet amphibious aircraft due to problems of water spraying up to the engines while landing and takeoff.

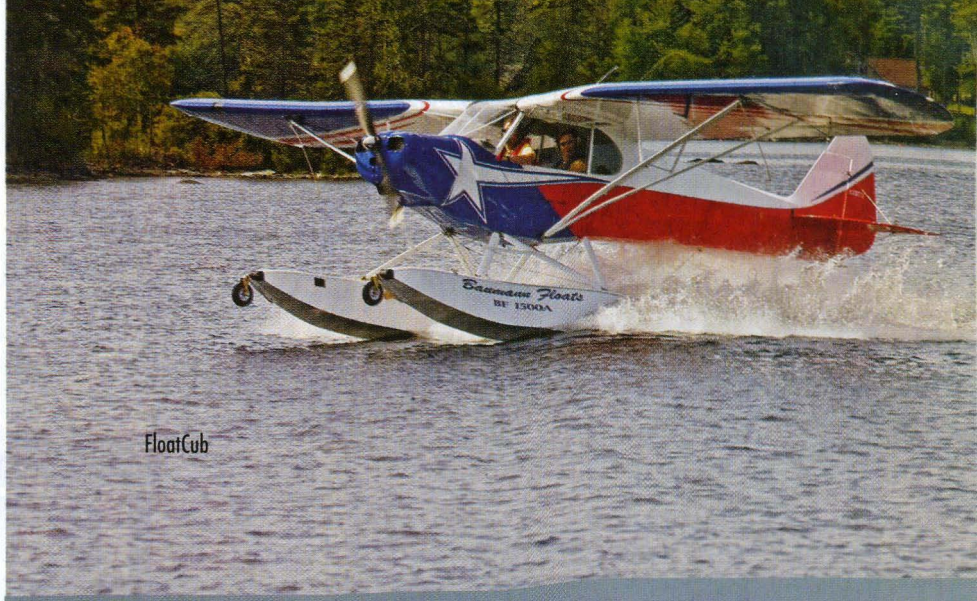
Piloting a jet amphibious aircraft is also a tedious task. Since water is much more viscous than air, while landing, due to the high speed of the aircraft during touchdown, the aircraft fuselage experiences a large reaction force. Moreover, larger jet amphibious aircrafts have a much longer takeoff and landing distance and greater speeds leading to spraying of water up to the jet engines, which can damage them. A skilful pilot is needed for handling a jet amphibious aircraft.

Present day amphibious aircraft are widely deployed all over the world because of their operational versatility. They are being mainly constructed for aerial firefighting, transportation of passengers and cargo, for conducting rescue missions at sea and are also being used by the military (navy) for patrolling the nation's coastline and for anti-submarine warfare.

It has been claimed that the amphibious versions of present day military fighter aircrafts are very unlikely to come into service. Present day fighter aircrafts use extremely modern technologies that are extremely sophisticated and delicate in nature. They are unable to withstand the impact of a water landing. Moreover, with the advent of stealth technology, modern military aircraft is being made invisible to radar and instrumentation detection. Presence of water on the aircraft's structure causes them to be vulnerable to radar detection and damages the internal instrumentation and onboard flight computers. A fighter aircraft lands with speeds above 200 miles an hour and with such a speed, the impact of the touchdown on water can cause considerable damage to the aircraft's airframe and to its onboard computer systems.

A reinforced fuselage or float induces extra drag on the aircraft and increases its overall weight, thus decreasing the speed and the rate of climb consuming more fuel and decreasing the operational range of the aircraft which are the most important factors looked for in today's combat aircrafts. Amphibious versions of military aircraft are also less maneuverable than their land-based variants. Work is in process to come up with the design of an amphibious fighter aircraft that can operate from land and also retain the characteristics and performance of land-based military aircraft.

Despite being heavier and expensive than the land-based aircraft, the use of amphibious aircraft in the commercial sector and for patrolling, firefighting and anti submarine warfare is increasing. Aircrafts like the *Beriev Be-200* and *The Bombardier 415* are protecting large forested areas by daily patrolling and surveillance. Their internal water/foam tanks store necessary fire retardants that are dropped onto the fire by the aircraft. Aircrafts like *Beriev A-40* are being deployed for anti submarine warfare, patrolling the nation's coastline.



FloatCub

Beriev A-40

Commercial amphibious aircrafts are being used for cargo and passenger transportation as they can reach remote areas and can land on water-bodies like lakes, carrying much heavier weight with a greater operational range, which was previously only accessible by helicopters. Amphibious aircrafts also bring down the cost of air—transport as it does not need airports and runways to be constructed.

Some time in the future we also do hope that amphibious aircrafts would become increasingly popular due to the growing amount of air traffic in today's airports and due to their operational versatility. They can be widely employed in search and rescue missions, patrolling missions, for firefighting and transportation, which are now limited to helicopters in many countries.

In tropical and sub-tropical countries the presence of a large number of local water-bodies and rivers will facilitate the growth of the amphibious aircraft industry as amphibious aircrafts, being able to land on water, will make air transportation more attractive for the common masses and will eventually make air travel faster and safer.

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Science Fiction Competition 2011

G.O.D. Saves the Earth

Saurabh Shukla

I took out the DNA Sample Collector from my pocket and handed it to him. I said, "Noah, here's something you need to do for the sake of humanity."
"What?" he asked.....

OUR school teachers had taught us: "*Never mess with any Xenophones*." And today, I am messing up with a whole army of them!

It all started a month ago when our peace treaty with those aliens failed. They are weird creatures, you know, the Xenophones. They are almost a crossbreed between a cockroach and a lion, with two whip-like antennas shooting out of their hairy faces. That's how I have always imagined them.

We have been enemies since the first Space Age and now it has gone beyond limits. Our enemy has shifted the warzone from the 'Present' to the 'Past'. There was a logic to this plan; How could our ancestors fight them with bows and arrows? So when they eliminate our past, they erase our future or, indeed US!

But it was only an assumption. Their plan was *even more horrible*.

Understanding the state of emergency, the Government constituted an organization – GLOBAL ORDER DEFENSE or **G.O.D.** G.O.D selected the best soldiers from all over the globe and luckily, I made my way into it. I am a G.O.D. soldier now, fighting Xenophones in a desert. I cannot tell you how frightened I am at this very moment. Every fellow soldier with me is dead or captured and the Xenophones are hot on trail after me. In short, I am now the 'Most Wanted' criminal in the desert. And guess what? I only have a small DNA sample collector given to me by a scientist to collect the DNA of the Ancient Earth, and not even a simple machine gun!

So, rather than crying over the situation, I decided to explore. It's a natural instinct in a soldier to always look for a way through the hedge and that's what I was going to do. We had no plan; neither had we known anything about their plan. What they were going to do and how? It seemed beyond our scope. But I first had to find out what they were up to.

Near the sea, a large dam was under construction. Many Xenophones were there at the site. What made my eyes widen was the main construction process – moving blocks and putting it in the right place was being done by the natives or US! And the natives seemed to be doing it happily. Weren't they a bit afraid of those large aliens?

"Why are they helping our enemy?" I murmured and decided to go undercover. I dressed like a native and galloped into the working crowd. I asked a native working nearby: "Won't they pay us anything?" He glared at me, before angrily whispering: "Are you new?"

"Yes," I said.

"I would kill you if you dared to speak against our master," he said and again busied himself.

"What? What have they done for you, eh!" I asked, trying not to look frightened. His glaring eyes were enough to frighten a soldier.

"Oh! May I know from where you are?" he asked.

"Africa," I said not knowing what to name.

"Ah! I think you might have known who gave you the wheel? THEM!"

We had been reading since first grade that wheels were a fruit of our mind but it seems it was not so.

I then found out that fire, boats, Pyramids and all other things were gifts to mankind. And to give a further blow, I learnt that they were going to destroy it soon. How? The native told me that our world was full of sinners and they needed to destroy them. So, this dam would be opened to destroy mankind to repay for the loss.

"Oh! You big liar aliens," I murmured. I needed to stop this.

Night was slowly creeping in and I needed shelter and food, but I found both out of my reach. I could not go to the village. The villagers might inform their masters.

At that very moment, I needed to do two things. First to survive and second, to safeguard the Earth. But what could I do with a DNA Collector?

I hopelessly wandered through the desert that seemed to stretch for miles. I thought of returning back to my broken spaceship but it was already too late. So, I decided to wait for dawn trying to work out a plan to stop their destructive plans.

I saw a man coming toward me. I decided to run, but found him waving at me. I waved back.

He was a tall man of thirty-five. He had a big moustache and blue eyes that were staring at me blankly. He was a native.

He understood who I was. I was afraid to interact with him lest he informed the Xenophones.

"Hello, who are you?" he asked in clear and fluent English.

"GOD," I said. GOD was our initial.

"Come with me," he said, and I followed.

"So, who are you and why are you helping me?" I asked, sipping the hot soup inside his small tent.

"My name is Noah, and I am helping you for the sake of humanity," he replied.

Something flashed inside my mind. Noah, Great Flood – it all felt so familiar, Yes, another flash, I had read it but where...? Then another flash – Yes, I had read it in the Bible-NOAH AND THE GREAT FLOOD. Everything was crystal clear now. It was foretold. I now had a well-defined plan.

I took out the DNA Sample Collector from my pocket and handed it to him. I said, "Noah, here's something you need to do for the sake of humanity."

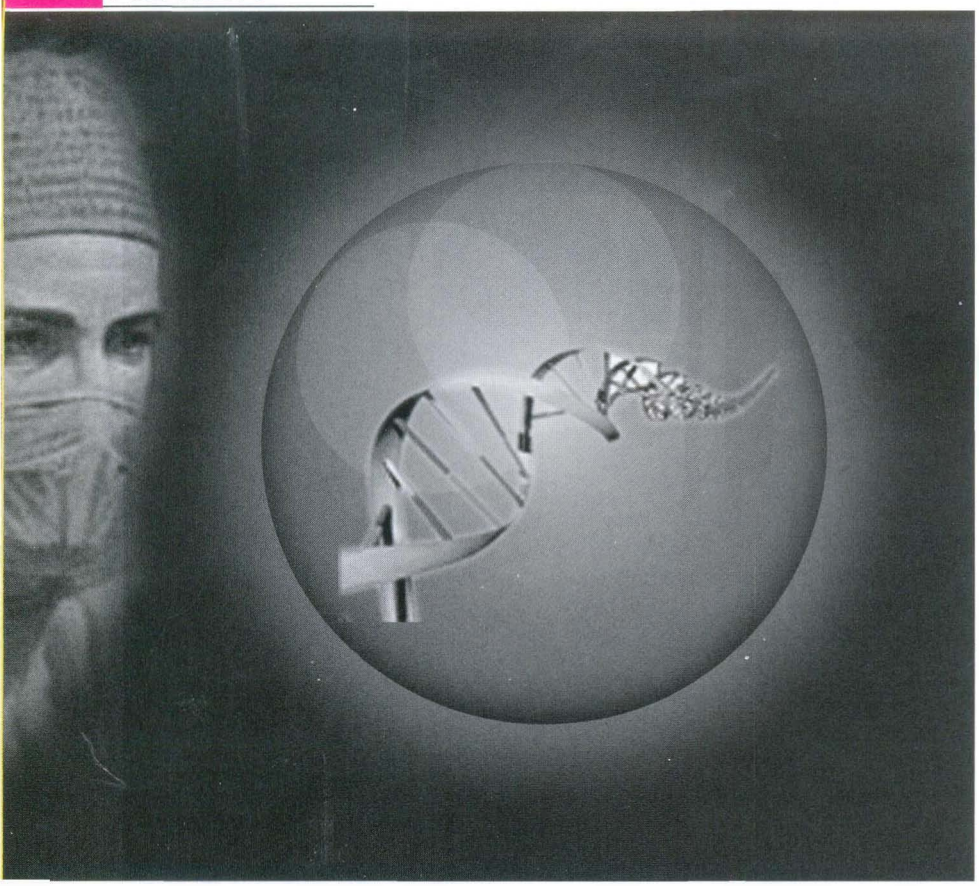
"What?" he asked.

"Do you hate them – the Xenophones...your Masters?" I asked.

"With all my heart," he said, further strengthening my will. I taught him how to use the DNA Sample Collector. Then I outlined my plan.

"Look Noah, I think you know what's going out there."

He nodded. I said, "They are searching for me all over and so, this thing you need to handle it yourself. You understand?" He again nodded.



"Whether I live or die, the human civilization would never die, it's my pledge," he said.

I instructed him to travel all around the globe and search for life. "Collect as many different types of DNAs as you can. Again, collect DNA's of both males and females. Look up in the sky, down into the sea and on Earth and find out everything precious you can that is worth keeping. Then, go back to the north and find the starship named ARK and board it. Stay there till it comes."

"Comes what?" he asked.

"The Great Flood," I said gravely. Patting him, I said as our Sergeant used to say, "I know the time is less and the task is big, but it's your nature to view it. Whenever you feel like backing off, close your eyes and think of a single man, who trusted you, had faith in you and then face the challenge with full zeal. You will see the work shrinking before your eyes."

"Whether I live or die, the human civilization would never die, it's my pledge," he said.

I saluted him. Suddenly, we heard footsteps outside. I knew my time had come.

The tent was at once overthrown by many armed Xenophones and the native with whom I had talked at the construction site. He pointed at me and said, "Yes, he is the man."

One of the Xenophones came near me. His foul smell nearly made me vomit. It's a tradition in these aliens that the loser needs to smell the horrible smell of the winner. But I was no Xenophone.

"I knew," he growled, "how can these poor and loser rats speak against us, eh God?"

"You are going to suffer," I said.

"We will see." They tied me and took me to their vestibular cells. It was very smelly. I saw many of the natives groaning inside the cells. I murmured to the Xenophone, "You have developed a rather good way to run a business. Would you like to brief me about it?"

He said, "We came here when our parent planet ran out of resources. Until then you humans had no realization of it. But when you started the war, we had to take revenge. Earlier, when we landed over this planet, your ancestors came to lick our feet. We grabbed the opportunity and made you our slaves. But we are no demons; we rewarded them for their work. Our technology was more developed than yours and so we gave them wheels, fire and many other things. They first amused themselves with it and came to us for more. We call them rats, and they lived like rats."

It was enough to boil my blood. I asked, "And how did the idea of their extinction come into your mind?"

"Reading your own literature humans – The BIBLE."

I wasn't in a mood to laugh.

The great day arrived, and they called me to witness the end of my planet. The blue roaring water slowly rushed from the open door and covered everything. The natives ran, shrieked and shouted and the Xenophones laughed till their face became black and blue. I closed my eyes to wipe the scene out and hoped for the safety of Noah.

It flooded the Earth for many days and nights. Everyday many died as the Mediterranean Sea drained all the water over its inhabitants. I prayed, watched, grumbled and sometimes even cried over it. But when it all calmed down, not a single living being was visible. But somewhere I was sure Noah might be safe.

One day, I got a chance to escape. Moving in a time portal was again a chilling experience. I had hoped to see a completely barren earth. But what I saw surprised me.

I had landed directly inside the base of G.O.D. The Sergeant was reading a book. He glanced and smiled at me. Noah had done it. He said to me: "Soldier, you know, I always thought who was that God who helped Noah get out of that situation and what his Ark looked like?"

"Well Sir, his Ark looked like one of our time travelling spaceship and about that God..." I continued, "I do not have the slightest idea."

He laughed in humour and I laughed in pride. The mission was accomplished.

Contributed by Mr Saurabh Shukla, Address: A2/71, Ambuja Parisar,Vill. & Post Rawan, Tehsil Baloda Bazzar, Zila Raipur, Chattisgarh; Email: saurabh_96@sify.com, maheshwari.shukla@ambujacement.com

"All Politicians Need to be Scientifically Aware"

Awareness Fosters Improvement

Scientific awareness is not just for the common man but is also essential for our politicians. With the

advancement of technology, our tasks have become much easier and secure. This includes solar lightening of streets, bio-metric attendance systems, advanced agricultural techniques, e-education, etc. Our politicians are the ones who have the ability to integrate these techniques and provide better amenities for the common people. Thus they should do away with their old approach of working and switch to the modernized scenario. Scientific awareness among our politicians will not only empower them with better options but also foster improvement in living conditions for the mass.

Subranjit Sahoo
Cuttack, Odisha
subhranjit@gmail.com

Scientifically Aware Politician Do Social Good

At the outset I appreciate your decision to select this topic. Certainly, it is to be mentioned that all politicians are urgently needed to be scientifically aware for the welfare of the country and also for the upliftment of the people. A country cannot be developed if the leaders of the political parties are not scientifically conscious.

Debasis Ghosh
Barrackpur, West Bengal

For Advancement

A politician must have a scientific mind, because it helps in making correct

policies for the common people. If a politician does not understand the problems of the people scientifically, then the politician is useless. For example, if our honorable late Prime Minister Rajiv Gandhi would not have introduced computer education in India, then till now we would not have become so developed and advanced.

Realm Phangcho, Class IX,
Pragtyotish Senior Secondary School, Guwahati, Assam

Broad Spectrum Knowledge

Politicians are always to be devoted for the welfare and development of people and country. They should be scientific and use rational logic in all matters. They

take social, economic and political decisions for the countrymen, and if they are biased and not scientific, they may put the community or country in the wrong direction. If politicians are scientifically aware they can govern the society, state, nation with harmony and lead the country towards prosperity.

Sunanda Mazumder, Class IX,
Pragtyotish Senior Secondary School, Guwahati, Assam

Scientific Politicians

It is very important that all the politicians should be scientifically aware because they are the rulers of our country. They need to set up political goals for the welfare of the country.

Moreover, in the world in which we are living the use of science and technology is increasing day by day. So, the politician who rules the country needs to be scientifically aware in order to do business with other countrie.

Dikshita Nath
Class IX, Pragtyotish Senior Secondary School, Guwahati, Assam

Politicians as Models

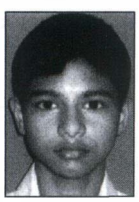
Today, India is reckoned as the largest democracy in the world. So, it is very important for the politicians

to be scientifically aware. The politicians are policy makers, so they should know the importance of science. For example, Rajiv Gandhi introduced the computer into India. He also believed that unless India stands up to the world, no one will respect us, only strength respects strength.

Sweety Das
Class IX, Pragtyotish Senior Secondary School, Guwahati, Assam

For Better Decisions

Politicians may be powerful but their knowledge of the science is low. The projects that are launched by the government are good but not effective. Take our state Assam. Today we are suffering for lack of electricity. In a day, a power cut occurs three to four times. The Government has launched the dam work but they have not yet thought about the



people living near the river. Because suddenly when the dam water will be released then the high-speed water will create a flood that may wash away the nearby villages.

Why India is behind America and Russia in technology till today? The only answer is that the politicians are not thinking about the scientific progress of our country. So, we are using machines and technology of other countries. So, politicians should be scientifically aware.

Anupam Mahanta, Class IX,
Pragtyotish Senior Secondary School Guwahati, Assam

AWARENESS OF TECHNOLOGIES

All politicians should have some scientific knowledge or be scientifically aware, as today 80% of our population depends on scientific technologies. Without scientific knowledge a politician cannot develop or run a state or a country. For example: Every politician should know the use of scientific technologies like computers, Internet, artificial satellites, rockets, missiles etc. Many of the politicians do not know the correct use of these technologies. They just think that these are just a way of wasting money, electricity etc. But, they are not aware how these technologies make their work easier, save their time and help to run their state or country in a peaceful manner.

Pratik Pran Buragohain
Class IX, Pragtyotish Senior Secondary School, Guwahati, Assam

NECESSARY FOR SUPERSTITION-LESS SOCIETY

Politicians are policy makers of a country. They have more interactions with common people than most other people. So, politicians have greater effect and control on the mind of the common people. If they are scientifically aware they can help promote scientific concepts and technologies to the society more. Fundamentalism and illiteracy makes this challenging, but politicians

can overcome these problems. They also can spread science to make a superstition-less, clear, open-minded society. Sometimes people are fooled by astrologers, if politicians become scientifically aware they can stop this.

Saurav Dwari, Assistant Teacher, Bhuarah B.N.S High School, Howrah, WB

SCIENTIFICALLY TRAINED POLITICIANS

Politicians are involved in policy making. So it is very important for them to be aware of scientific issues. Climate change, impact of genetically modified plants, diseases caused by radiation, environmental impact by mining are some of the issues they must consider and discuss in the sessions. But most of our representatives are not scientifically trained. There should be minimum qualification for politicians. Collecting data and analyzing it scientifically will give good results.

Naveen Kumar B L,
NIE Mysore,
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SCIENTIFICALLY ADVANCED SOCIETY

The common man wants to live in a science-friendly and scientifically advanced society. Politicians have to take initiatives to make this desire of their people true. Being scientifically advanced would help a country to improve its infrastructure, minimize crimes and strengthen its defense. So, being scientifically aware will help the country tremendously.

Rajiv Ratna Jha
J.K.G. International School
Ghaziabad, U.P.

GOVERNANCE CLOSELY TIED TO SCIENCE

Politicians are the leaders and policy makers of a

country. There is not a single field of governance that is isolated from the scientific approach. Even if recommendations have been given by scientific institutions or committees, politicians always take the final decisions. Without awareness in science ,how can we expect them to take appropriate decisions? So, they should be scientifically aware.

Ashutosh Kumar Jha Dheeraj
Lloyd Law College, Greater Noida
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NEED OF THE HOUR

Today, in the age of globalisation and sustainable development, politicians must possess scientific awareness as they are the policy makers of the nation. Knowledge of the scientific aspects of any programme or policy whether on climate change or poverty eradication is a must as it helps to provide more relevant and solution-oriented results and regulations. Insufficient scientific and environmental awareness leads to ineffective policies.

Dr. Aditi Bhardwaj
Karnal, Haryana

KNOWLEDGE OF WHAT SCIENTISTS DO

It will be great for any nation if its politician's have scientific knowledge, at least a minimum level of general knowledge about what scientists do. In case of India, the agricultural sector occupies almost 43%

of India's geographical area and also plays a significant role in the growth of the socio-economic sector. Scientifically literate politicians can boost the agricultural sector.

Satish Kumar
University of Delhi
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POLITICS MORE POWERFUL THAN SCIENCE

No is the answer in the current scenario. Though all politicians need to be scientifically aware, the history of Indian politics and politicians reflects that politics is more powerful than science. Politicians have such powers that they are able to tear down the entry path of scientific investigations in many cases. Our constitution has to provide certain special rights for scientific investigations over politics for clear governing in India.

Prabodha K. Meher
Nehru Gram Bharati University
Allahabad, U.P.

BASICS ARE A MUST

It is not necessary for politicians to be deeply scientifically aware, however they should have a scientific temperament and promote scientific

research. It is required that they know the basics of science so that they could deal with issues related to the environment and decide on how science can help strengthen our country's development.

Aparna Krishnamurthy
aparna94k4@gmail.com

PEOPLE SHOULD BE SCIENTIFICALLY AWARE

There is no need for all politicians to be scientifically aware; rather, the majority of the people should be scientifically aware for the sake of their own interest. The common man needs to incorporate changes in his life helping the country to keep pace with the rapid scientific developments taking place all around the world.

Mohar Ghosh
Shymnagar, Naihati

FOR BETTER ANALYSIS

Scientific awareness is needed to run the country well. For example if the Tamil Nadu Chief Minister or the former Union Environment Minister had been scientifically aware of the controversies regarding the Kudankulam nuclear plant, the problems wouldn't have cropped up. A preliminary probe by scientists has reported that only 0.21% of people living within 8 km of the nuclear plant had cancer cases. So, instead of jumping to conclusions, politicians must do a complete analysis and display a scientific temperament. If politicians display scientific temperament the public will also follow suit.

S. Rajesh
West Bengal

NOT NECESSARY

Politicians should have remarkable leadership qualities, scientific awareness will just be another feather on their cap. Most rules and reforms are formulated by the experts and bureaucrats, and the politicians present them. A politician should essentially be literate, honest, patriotic, selfless, worldly wise, have a clean past, see that they can represent the nation and its citizens' will and also ensure proper implementation of laws – scientific awareness can be an add-on.

Rituparna Dubey
Faridabad, Haryana

FOR CRITICAL EVALUATION

India today needs leaders who are scientifically aware because they will be better prepared to tackle corruption and other issues by using the latest technology. They will be better prepared to cope with the demands of today's technological society. They will be better positioned to evaluate and respond to the issues of people like health, economy and security because they will think critically. Politicians must be aware of the importance of research, study, scientific analysis and exploration in order to help society move forward. If politicians do not understand science they can plunge society into darkness. A society should not leave its spiritual aspects for science but should work towards a harmony between science and spirituality. Leaders can help this aspect only if they are scientifically aware.

K. Vinay Krishna
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ALL POLITICIANS NEED NOT BE SCIENTIFICALLY AWARE

The state is the entity that engages in this activity in practice while the people engage in it by taking the state to task. To wipe out

peoples' grievances requires unbiased and effective policies and schemes usually passed by politicians. In order to implement policies, science and technology play tremendously vital role to get fast, accurate and anticipated result. Politician can solve peoples' problems without any awareness of science and technology just by raising issues of the people and formulating solutions after utmost contemplation. But, politicians should be aware of fundamental technologies like computer, Internet, mobile etc. so as to use them for collecting information regarding living status of people.

Mohd Aquib
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NOT NECESSARY

All politicians necessarily need not be scientifically aware but they should be literate and rational. The bigger point of concern, I believe, is literacy. Because when a politician is literate, he or she would know how to govern and handle issues related to science. A rational mind would know the right and wrong of his/her nation and how to react to a particular situation.

Ipsa Arora
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FOR RATIONAL DECISIONS

Scientific awareness deals with detailed study of cause and effect. Politicians being the representative of the people are entrusted with

the highest accountability to take decisions for the welfare of the society. Before taking any decision they need to go for a complete SWOT analysis of cause and effect of the decision to be taken. A small mistake or ignorance of the ill-effects of the decision may disturb the socio-economic balance of the society. Thus, it is a must for our politicians to be scientifically sound and aware for the benefit of the common people.

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SCIENTIFIC DECISION MAKING TO BENEFIT HUMANITY

The development of a nation is dependent on science and technology. The aim of the politicians should be to work for the progress of the country. But due to lack of scientific awareness politicians may take only politically useful decisions about science, which may be harmful for the future of the people. For example,

huge amount of water is pumped out from the earth causing terrible arsenic pollution. So, all politicians need to be scientifically aware about the merits and demerits of all scientific activity.

Nikunja Behari Ghorai
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IMPORTANT FOR ALL

Science has a role at the every stage of our life. So everyone should have basic idea about science. Politicians, who are elected, have a greater responsibility for the society. Their actions and decisions have a direct impact on the people. People who are in charge of important departments like Defence, Finance, Industry, etc. must have some scientific views which will make their action more relevant and favourable for the country.

Ankit Kumar Sahoo
VN Junior College, Odisha
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NURTURE SCIENTIFIC ATTITUDE

All politicians may not be scientifically aware or technically sound as they come from diverse educational backgrounds. But what we need is to grow true scientific temper and nourish logical attitudes towards decision-making. Science generally becomes subordinate and hypocrisy and bias predominates. In this context the political tug of war regarding EIA report of the project of Vedanta group in Orissa is a typical example. In this scenario, a logical approach is mandatory for India's technological advancement.

Avik De
Asansol Eng. College
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AGENTS OF CHANGE

Science makes us educationally equipped and

helps us make informed choices. Development of a country depends on its technology and advancement. Hence politicians who are the representatives of the nation must be scientifically aware so that they become agents of change

Anshika Seth
Patna, Bihar

TOWARDS A SUPERPOWER

It is the prime responsibility of politicians to implement decisions that benefit the common masses. This can be fulfilled only when all politicians have scientific awareness and temperament. Pandit Nehruji's scientific temper has created world-class scientists, engineers, technocrats and doctors, by the creation of excellent educational institutes and government owned and sponsored research laboratories. He further, called such institutes as modern temples! Our former President A.P.J. Abdul Kalam is an exemplary who was scientifically aware. Let us hope all politicians develop a scientific temperament, which will go a long way in making the country a super power by 2020!

P.K. Sakharkar
S.F.S. College, Seminary Hills, Nagpur
pksakharkar@yahoo.com

SCIENTIFICALLY AWARE POLITICIANS CAN IMPROVE OUR LIVES

If politicians are scientifically alert then our country will surely prosper.

Their scientific awareness is related to our welfare. Scientifically advanced politicians could improve the way of our living. They could improve sanitation, farming, public transportation, education – the list goes on and on.

Avirup Chatterjee
Durgapur, West Bengal

POLITICIANS AND THEIR SUPERSTITIONS

We live in the lap of science. So, every man needs to be scientifically

aware and not believe in superstitions. But, nowadays in our country we can see some superstitious politicians who go to astrologers before election. They also wear many kinds of metal rings, gemstones etc. So all politicians need to be scientifically aware.

Manoj Mondal
Habra, West Bengal

SCIENTIFIC ARCHITECTS

Politicians are the link between the common people and national

development. Can development happen without science? For administration and social development, the politician should be aware of new scientific developments. Cell phones, Computers, EVMs etc all are necessities of life. So politicians without scientific outlook are detrimental to the progress of the nation. With science they become "Scientific Architects" of the nation.

M. Bhavana Reddy
Paloncha, Andhra Pradesh

Now write in your thoughts on this topic:

"Superstitions & irrational beliefs arise due to ignorance."

Be short, crisp and logical. Send in your photo, if you like.

MADHAV VISHNUBHATT

Talking of Language

Why do human societies have language? Is there a "language organ" in human beings? What led to the evolution of human languages?

REMINDING ourselves that we too are animals is exhilarating and at the same time humbling. When we look at human beings in comparison with other animals, we see that every biological feature of human beings has a counterpart in the animal kingdom. This comes out most strikingly when we compare ourselves with our closest cousin, the Chimpanzee.

But does this mean we are not different from other animals in any manner? No, of course we are different. There is one aspect of humans that no other species on Earth has: language.

But are we sure other species do not have a language?

Many attempts have been made to find out whether chimpanzees can understand or use language. Early experiments to see if they could learn or understand spoken language failed as vocalisation of words was tough for chimpanzees. But Washoe, a chimpanzee born in 1965, was trained to use the American Sign Language. At the end of the experiment Washoe had learned 350 signs out of which she could use 150, and understand 200.

Another such experiment presented in a science show on TV tried to find out whether Vervet monkeys have a language. Vervet monkeys appeared to use three separate calls for different kinds of predators. When a Vervet monkey saw a snake, he made a "snake alarm call". On hearing this all the other monkeys stood up on their hind legs, trying to look for the snake. When a monkey saw a leopard, he made a "leopard alarm call", hearing which all the monkeys on the ground ran up into a tree. Similarly, an "eagle call" resulted in all the monkeys looking up to the sky for an eagle. On hearing the "eagle call", the Vervet monkey did not run up into the trees, for the fear that they would then become vulnerable to eagles picking up the young ones off the trees.

There have been reports that whale songs are like languages. But in these reports, the very scientists who worked on the research agree that what was observed in whale songs, is only a hierarchical structure of sounds.

But do these three cases suggest that language is not unique to humans? This does not seem to be the case. Even though the above examples could have been the precursors to a language, they are definitely not languages in the sense that we human beings use it.

A language is not just a collection of words. Syntax is the life of a language; the beauty and intricacy of the language comes from the different ways in which words can be brought together. Language forms an important part of how individual human beings and societies establish complex meanings about phenomena. Animal communication does not match up to the semantic complexity of human language.

From thinking that language is the result of a general capacity of our brains to learn something new, we today know that language is innate and have progressed to offer theories about its evolution.

Is Language Learned or Innate?

There was a time when language was considered an invention like the wheel. Language is acquired only when taught by parents and society, and thus it was assumed that language was the result of the brain's general capacity for learning.

But language exists wherever human beings exist. There has been no civilisation without a language. In contrast, there have been civilisations without wheels. This could

Washoe, a chimpanzee born in 1965, was trained to use the American Sign Language

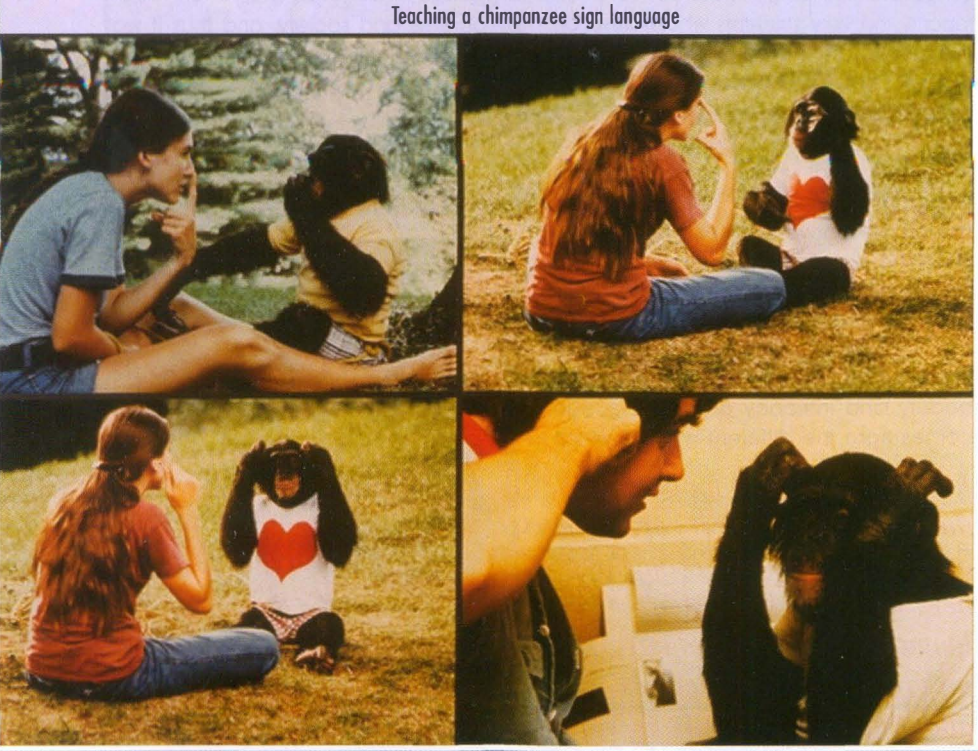
either mean that languages are so indispensable that any civilisation that does not invent a language cannot survive, or that language is something innate in human beings. Innateness has also been sometimes expressed by linguists by ascribing the epithet "language organ".

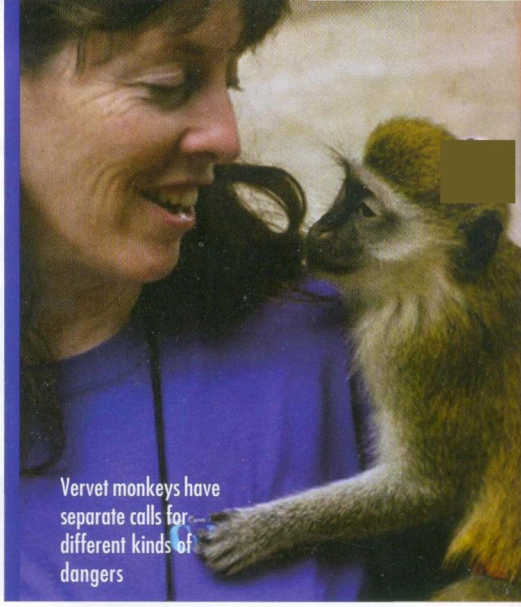
Today, it is widely recognised that language is definitely innate to an extent. This, of course, does not mean we are born with English, Hindi or Tamil vocabularies, but that the language that the child learns depends entirely on where she is brought up and what she is taught. A child of Tamil parents brought up in a Telugu family from birth will learn Telugu and not Tamil.

When it is said that some part of language is innate, it means that we are born with a capacity to grasp a language's structure, syntax, exceptions, the different types of words involved etc. When we grow, this capacity is activated as we learn vocabulary from our parents or from our society. Though a chimpanzee can do other things that humans do, like using tools and sorting objects, no amount of teaching can make a chimpanzee learn a language.

Looking at how new languages originate in special cases further buttresses the argument that language is innate. There have been some interesting natural experiments on how new languages are formed. These usually happen when peoples of two different languages are brought together and made to live in close contact forcibly for a long time, like when labourers move from one place to another *en masse* in search of work. In such cases, it has been observed that these groups form a new language, which is a mix of both the native languages of the speakers. Since one cannot understand the other's native language, they come to some form of a compromise on a language. Such languages are called pidgins. These are not as complicated as full-fledged languages. They contain only the simple elements needed to get enough communication going for co-operation, planning, transfer of information etc. For example they might avoid the recursive structures that enable us to make sentences like "I went to the movie, whose

Teaching a chimpanzee sign language



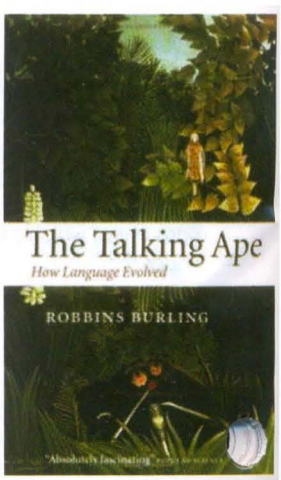


Vervet monkeys have separate calls for different kinds of dangers

leading star is Shah Rukh Khan, who also acted in Fauji, which was a popular serial on Doordarshan, which is the government owned channel of India and was the only one till a couple of decades ago" and so on.

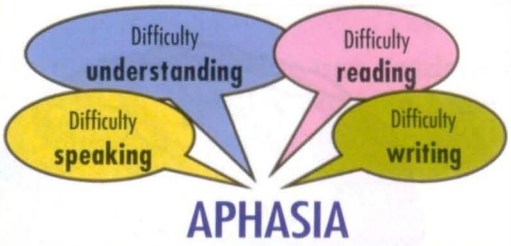
Once people speaking different languages come together, the next generation of children, who grow up in the pidgin environment imbibe the pidgin language as their primary language. As they grow up, they make the pidgin language complex and convert it into a full-fledged language with all the complexities that we expect to see. These languages are called creoles. As we know from experience, it is incredibly hard to learn a language as an adult. That is why adult populations with different native languages who live together form pidgins, and not full-fledged languages. But once children start using pidgins, they take it to its most complicated form.

Even speaking and hearing are not prerequisites for a language. The sign languages used by deaf-mute people also have advanced structures like any other spoken language. It is nothing like the game of dumb charades. The American Sign Language is an intricate language at par with other languages.



There have also been cases where deaf-mutes created their own language when they were secluded

There are reports that whale songs are like languages



Brain injury could cause aphasia

from other language users. This happened in Nicaragua, where the government had established a school for deaf children. These children had never before seen a sign language, and on meeting, they innovated on the signs that each one used individually and came up with a new sign language. According to an American linguist who studied this, it was on par with a regular language.

That language is innate is further supported by disorders that fall under the class of Aphasia, defined as "partial or total loss of the ability to articulate ideas or comprehend spoken or written language, resulting from damage to the brain caused by injury or disease." These problems usually arise from brain injury, stroke or tumour. These disorders affect a person's ability to use language; he may fail to understand spoken language or to speak grammatically.

In fact, a disorder called Anomia affects the ability of the person to remember nouns. People, who suffer from this, are unable to recognise the names of people or things. Though unfortunate, it is intriguing that there is a specific area in the brain for nouns.

Evolution of Language

All these cases suggest that there are innate factors that enable us to learn language, and it should have arisen gradually in a step-by-step manner like everything else in evolution.

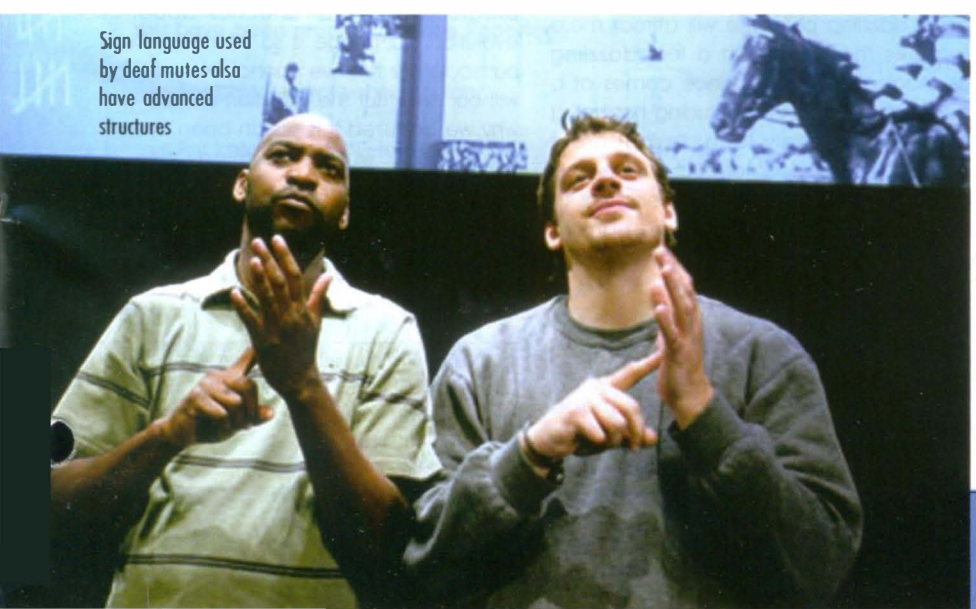
We do not have all the answers, since spoken language does not leave any imprints like fossils, and it is tough to know when it actually started off or how it progressed from just vocalisations to the wonderful complexity that we see today.

Evolution by Natural Selection, the theory proposed by Charles Darwin and Alfred Wallace, is the only known process through which complex traits can evolve. For example, our eyes evolved as an adaptation through natural selection, since those who have marginally better eyes do better than those who have slightly less efficient ones (e.g. find prey or mates much better, or spot a predator a little bit earlier than the rest). Such individuals will survive longer to breed more offspring, who also have a high probability of inheriting those slightly better genes leading to better eyes. This advantage ensures that over long periods of time, the population moves towards better and better eyes. So is the case with opposable thumbs in our hands or our immune system.

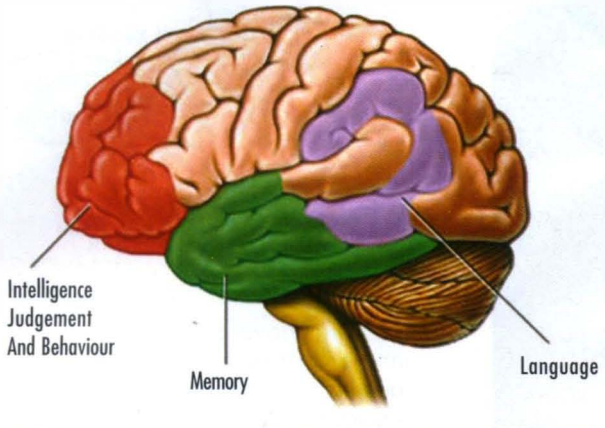
But that does not mean that everything in our body has a purpose, some features might just be side effects or by-products of other processes. For example, the small groove on our upper lip just below the centre of our nose, called philtrum, does not have any specific purpose. The philtrum is the result of the development of our face in an embryo, where the two parts that developed separately are joined at this point. If these two parts do not come together at the same time, it leads to cleft lip problems. Similarly, the red colour of blood itself does not have any specific purpose, but it is a side effect of the haemoglobin molecule being red. If haemoglobin was blue, our blood would have been blue and it would not have impacted us in any way. So, everything that we possess need not have an evolutionary purpose.

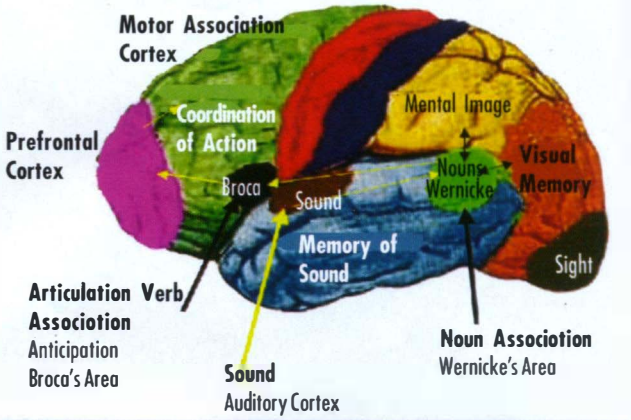
Noam Chomsky (an American linguist considered to be the father of modern linguistics) and Stephen Jay Gould (an American palaeontologist and hugely popular science writer), have suggested that language could be the side effect of a rapidly evolving brain of our ancestors. As our brains started to analyse more and more complex problems they also developed the capacity for language as a by-product. Although coming from heavyweights in their fields, this argument is not entirely convincing – that such a complex thing as language could have come about as a by-product.

In this vein, linguists Steven Pinker and Robbins Burling have argued that language is too specific and complex to have come about as a by-product. Rather, language itself is evolution too, and could be explained by Darwin's theory of natural



Sign language used by deaf mutes also have advanced structures





The brain is supposed to have a language center and also specific area for nouns

Language exists wherever human beings exist. There has been no civilisation without a language. In contrast, there have been civilisations without wheels.

selection, as long as we can ascribe a good purpose to it.

At first glance, the question seems to be a simple one. The purpose of language is communication and coordination, like planning how to catch an animal, how to distribute it and so on. So whoever communicated better had an advantage over others with lesser communication abilities. Moreover, people who have better communication skills will be seen as important people in their groups. Remember how impressed we are by people who can tell a joke in just the right way, or give a moving speech?

However, as Robbins Burling argues in his book *The Talking Ape: How Language Evolved*, the story does not end there. If the purpose was only communication, then animals do it well enough even without language. Packs and herds of animals hunt in a coordinated manner that would need a lot of communication, but they still manage without a language. Apes have complex social lives without a language. No doubt, none of these means of communication are as effective as a language, but if they can do without a language why do we need one? Even if language were necessary, would a pidgin language not have sufficed? Why do we need such an elaborate language?

As evolutionary psychologist Geoffrey Miller, says in his book, *The Mating Mind*, "Human language evolved to be much more elaborate than necessary for basic survival functions."

Sexual Selection Hypothesis for Evolution of Language

Robbins Burling suggests that, even though language started off as a tool for communication and coordination, its complexity owes itself to another process proposed by Charles Darwin called sexual selection. In this he refers to Geoffrey Miller's argument in his book that language and other aspects of human culture like music evolved as a result of sexual selection. Sexual selection is a special case of Natural Selection. In natural selection, nature acts, unconsciously, as the driver of selection, whereas in sexual selection members of the opposite sex of the same species act as selectors.

A classic example given for sexual selection is the beautiful plumage of peacocks, which exists only to impress other females. So a male peacock with a more dazzling plumage will attract more females than one with a less dazzling plumage. This extravagance comes at a cost to the peacocks, including not being able to fly freely and being more conspicuous to predators. But this risk itself could be a means for the peacock to advertise its health as if to say, "I am so healthy, that I can survive in spite of costs of the extravagant plumage". This could mean that females who choose males with bright and bigger plumage, are choosing the healthy ones. This leads to an evolutionary competition between males, wherein successive generations are selected for more extravagant plumage.

Thus, the features that evolve due to sexual selection are more like fashion fads. They don't really serve a purpose, as can be seen by the fact that peahens manage perfectly well without the plumage.

Thus, in addition to the obvious utility of a language, sexual selection too would have played an important role in making language what it is today. Geoffrey Miller also says that the very uniqueness of language in the animal kingdom suggests that Natural Selection could have played an important role. This is because Sexual Selection does not reinforce traits for their use in survival. Hence its pressure could be based on any whimsical trait. Not being utilitarian, the traits that evolve via sexual selection have lesser probability of being replicated by any other species. Thus the trait chosen for has a higher probability of being unique, than traits favoured by natural selection.

From thinking that language is the result of a general capacity of our brains to learn something new, we today know that language is innate and have progressed to offer theories about its evolution. Language is so intertwined with our social life that we cannot think of living without one. But the question of how and why we acquired it is still an open one.

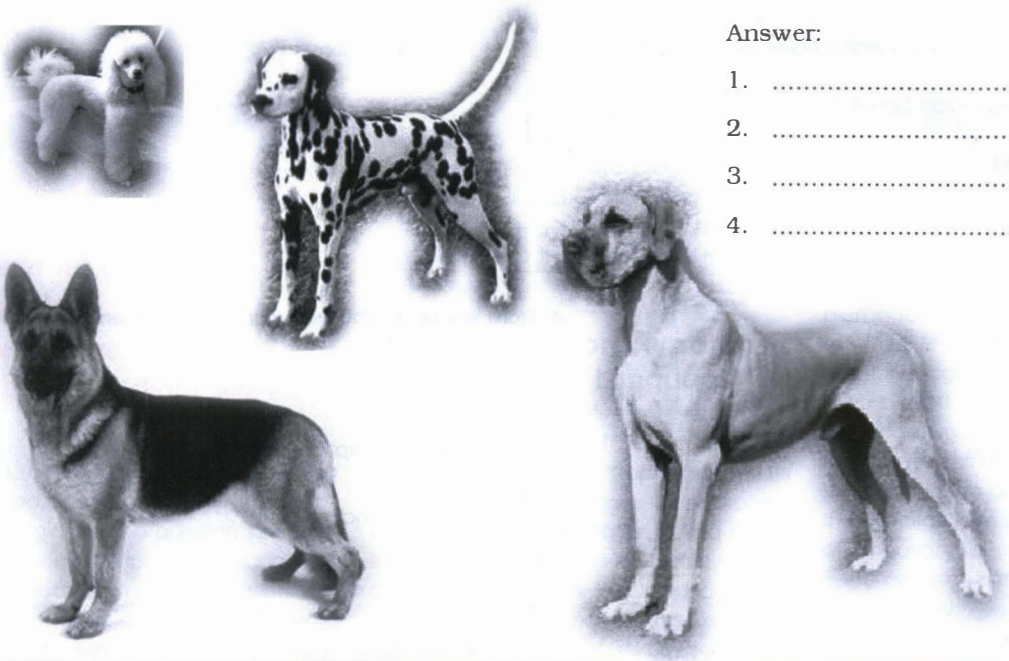
But as with everything else in science, this uncertainty is provisional. Who knows what advances could come up tomorrow to inform us about the origins of our language? We can only wait and watch.

Mr Madhav Vishnubhatta is working as a Software Engineer in Chennai. Address: Flat 31, Block IV, Maan Sarovar Raaja, 11A, Arcot Road, Porur, Chennai–600116; Email: madhav.vishnubhatta@gmail.com

Prize Puzzle

DOG PUZZLE

Albert is a keen dog admirer and over the years has had a number of dogs. He has had an Alsatian, a Dalmatian, a Poodle and a Great Dane, but not necessarily in that order. Albert had Jamie first. The Dalmatian was an adored pet before the Great Dane. Sammy, the Alsatian, was the second dog Albert loved. Whitney was housed before the Poodle and Jimmy was not a Great Dane. Can you tell each of the dogs' name and the order in which Albert had them?



Answer:

1. .....
2. .....
3. .....
4. .....

There are three prizes of Rs. 500/– each for three correct entries. In case there are a large number of correct entries, the prize winner will be selected through a draw of lots. The decision of the Editor, *Science Reporter*, will be final.

Send your entries to
Puzzle Corner
Science Reporter
National Institute of Science Communication And
Information Resources, CSIR, Dr. K.S. Krishnan Marg
New Delhi-110012

Last date for the entries to reach us: 05-10-2012

Your Name : .....

Address : .....

.....

.....Pin Code : .....

Age : .....E-mail :..... .....Sex : .....

Occupation : ☐ Student ☐ Housewife ☐ Teacher ☐ Professional ☐ Retired ☐ Other

Educational Level: ☐ Primary ☐ Secondary ☐ Graduate ☐ Postgraduate

*Please fill up the questionnaire at the back

*Please note: Now you can even send your answers on a photocopy of this page.

SUDOKU

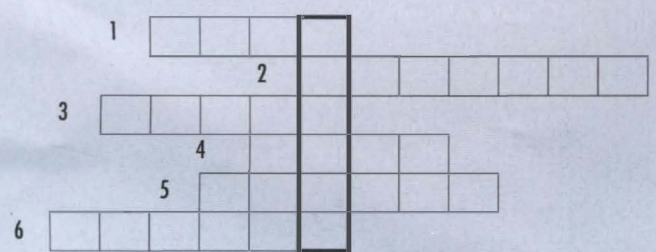
In the grid given below, fill in the black-coloured grid with objects that are black (HAIR, UMBRELLA, COAL & SOOT), and in the grey-coloured grid fill in the objects that are green coloured (LEAF, PARROT, BEANS, ALGAE & GRASS). Every horizontal and vertical column and every 3 x 3 box should be filled with black and green-coloured objects without repeating any. You cannot change the object already given in the grid.

HAIR			SOOT					PARROT
		PARROT		UMBR-ELLA	LEAF	BEANS		
	GRASS	UMBR-ELLA	BEANS				COAL	ALGAE
GRASS	COAL		HAIR		PARROT	LEAF		
	HAIR	SOOT					ALGAE	
		BEANS	GRASS		COAL		SOOT	
	PARROT				BEANS		GRASS	
		LEAF		HAIR		COAL		
COAL	ALGAE				SOOT			BEANS

Contributed by Dr K. Venkataraman, AT2 Porkudam Apartments, Bypass Road, Madurai-10

AIM AT THE EYE

With the help of given clues fill up the blanks across, forming a word in dark boxes that refers to the white of the eye.



1. The flat circular coloured membrane behind the cornea of the eye.
2. Layer of the eyeball between the retina and sclera.
3. The dark circular opening in the center of iris of the eye.
4. A piece of transparent substance for concentrating light rays in the eye.
5. Transparent layer covering the front of the eye.
6. Layer at the back of the eyeball sensitive to light.

Contributed by Mr Raashid Jamal, Nana Saheb Ka Bara, Bazaria, Dholpur (Rajasthan)-320001

SOLUTIONS TO PUZZLES PUBLISHED IN THE JULY 2012 ISSUE

PRIZE PUZZLE:

CANDY FOR THE KIDS

Abhay had 2 pieces,
Sunny had 4 pieces,
Chatur had 8 pieces, and
Vishal had 4 pieces.

KEYBOARD KEYS SEARCH

E: Period, Hyphen, Percent
NE: Dollar, Equals, Plus
N: Asterisk, Apostrophe, Close bracket, Question mark, Open parenthesis
NW: Underscore, At
W: Quote, Less than, Caret
SW: Slash, Colon
S: Ampersand, Grave, Minus, Open brace, Comma
SE: Tilde, Hash

THE WINNERS OF THE PRIZE PUZZLE BASED ON THE DRAW OF LOTS FROM AMONG THE CORRECT ENTRIES ARE:

1.Khusbu Mishra,
D/o Mr Rajendra Mishra,
Above Hindustan Tyre, NH 31.
Opp. MES Pump House,
Mal Bazar, Dist. Jalpaiguri-735221

2.Kanchan Kumari,
A-9/1, Mathur Vaishya Nagar,
Tonk Road, Jaipur,
Rajasthan-302022

3.Mahale Ambadas Nivrutti,
C/o Mr Avinash L. Waje,
Type-III 22/08, Rang Hills Estate,
Khadki, Pune-411020

CONGRATULATIONS ALL THE WINNERS!

Puzzle **'Trees in a row'** published in SR August 2012 issue was contributed by Mr A S R Murthy, Sr Engg Asst, Doordarshan Relay Centre, Devarakonda 508248.

FEATURE ARTIC

Unique Organisms

A. KRISHNA MURTHY & V. PRANITHA

The Animal Kingdom is full of wondrous creatures which are one-of-a-kind due to their appearance, functionality and behaviour. Do you know about the uniqueness of these organisms?

THE word "unique" according to the Oxford Advanced Learners' Dictionary (8th edition, 2010) means "only one of its kind" or very special. Some animals fall under this category. They are so special that they stand apart from the rest. For instance, the blue whale is unique because of its giant size. Being novel may also relate to functions like glow worms "luciferae" giving out green luminescence at nights. Being unusually cleaver or intelligent may be the trademark of some organisms.

A Very Special Physician

Dr. Andreas Michalsen and colleagues from Essen, Germany published a paper titled "Effectiveness of Leech Therapy in osteoarthritis of the knee" in *Annals of Internal Medicine*. They reported how 24 patients with osteoarthritis, which causes wear and tear of the ageing knee, were given one-shot leech therapy. Four to six leeches were allowed to attach themselves to each knee and drink blood for about an hour. Twenty-seven others with the same ailment were given twice daily doses of the painkiller Diclofenac for a month. Result: Leech therapy was better than drug therapy!

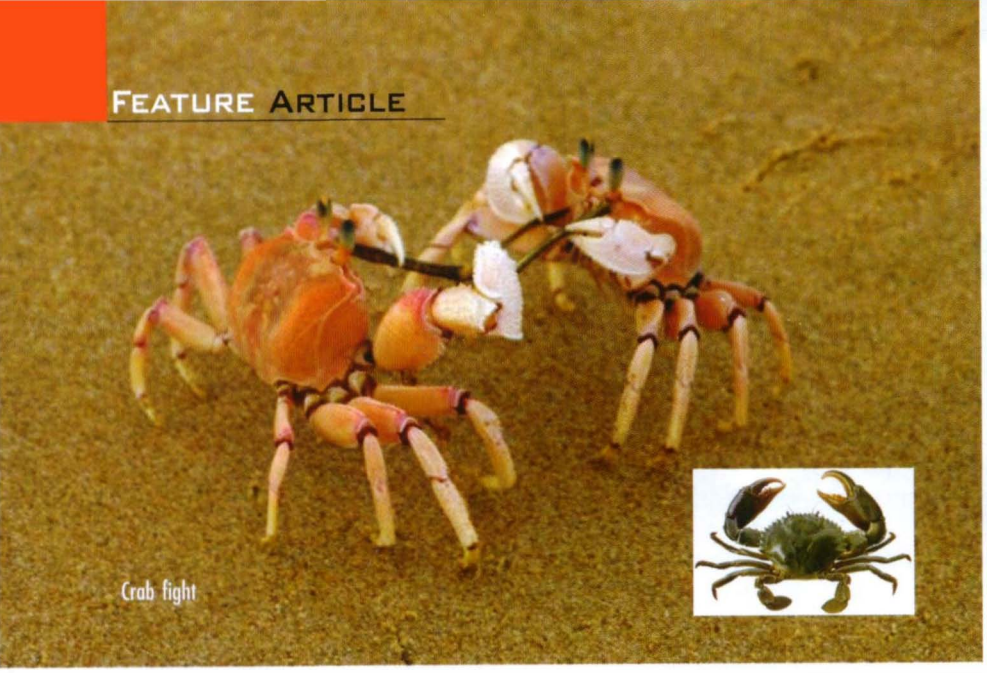
This unique leech therapy could benefit not only osteoarthritis patients but also those with other causes of pain. Ancient Egyptians, Greek and Indian medicine men used the leech to help maintain what they supposed to be the humoural balance in the body (the four humours being blood, phlegm, black and yellow/bile). They attached leech to the body for the cure, and detached it by sprinkling some salt water.

Of the 130 species of leeches, the one used in medicine is called *Hirudo medicinalis*. This quaint, dark leech has five pairs of eyes (to see better) and two suckers both on its front and back side. The head sucker "searches" and penetrates while the tail sucker holds fast to the host. The bite of hirudo is painless. It has an anaesthetic that makes the bitten host feel nothing. Biologists are studying this substance in order to understand its chemical nature and mechanism of action.

Besides this, the leech saliva has many other molecules of great medicinal interest. One of them is a vasodialator and a histamine that increases the diameter of blood vessels, helping to promote blood flow. Another is an enzyme called hyaluronidase, which breaks down hyaluronic acid, the bonding material of connective tissue, thus fostering the flow of blood and fluids from affected areas.

By far the most interesting substance in leech saliva has been hirudin, a molecule that is the most potent inhibitor of blood clotting known to date. Hirudin in leech guarantees continued blood flow by breaking off the aggregated fibrin plugs that clot and seal blood leaks. Hirudin also shuts off the mechanisms of Factor VIII mediated blood coagulation. Indeed, even after the leech drops off after feeding, blood seems to flow for a while from the animal, thanks to hirudin. Genetic engineers in England have been able to clone the gene for hirudin and manufacture it through recombinant DNA technology.

We need to be thankful to the leech for the benefits it has now opened up for modern medicine. Had it not been for *Hirudo*, we would not have hirudin and its cousins balellin and eglin. Neither would we have appreciated the roles of hyaluronidase and the salivary anaesthetics. And the poor fellow drinks hardly 15 ml out of the 3000–5000 ml of blood that we humans have in us. And having drunk, the parasite doctor moves on to chew the cud for six months.


Crab fight

Crab's Mind

It is possible to work out what is going on inside the mind of the crab. Robert Elwood and his colleagues at Queen's University in Belfast, UK have succeeded in probing the crab's state of mind as it makes tactical decisions about a fight. It turns out that crabs weigh up potential gains from the fight, which is then translated into a greater or lesser motivation to continue. Some sort of assessment is made about whether, for example, the potential male is suitable or might be too risky to forage in an exposed site. That is not to say that there is no planning, but there is certainly something going on in the brain to guide particular lines of action.

Elwood's group has decided to probe one of these complex decisions whether to fight or not. They say that "if possible, animals should assess both the relative fighting abilities and value of resources before making tactical decisions during contests". They believe that the decisions are implemented by changes in the motivational state of the animal. But how does one measure the motivational state of say, a crab.

The researchers have managed it and they described exactly how in the most reputed Journal (*Nature*, May 7, 1998). These organisms occupy the empty shells of a variety of gastropod species – snails and the like. Envious crabs often attack those in more desirable residences in an attempt to evict the current occupant and claim the dwelling for themselves. European hermit crabs (*Pagurus bernhardus*) tend to prefer shells to suit their own size and periwinkle shells are the most desirable of all.

Fights can get quite unpleasant. Generally, the attacker (the larger crab) grabs the shell of the defender causing the latter to hide inside. The attacker may escalate things with successive bouts of rapping at the shell and grabbing any exposed part of the hiding crab. If the defender loses the grip of the inside of the shell, the attacker quickly plucks it out. But at any time the attacker may just give up the fight. The researchers wanted to know what changed the motivation or intention to fight.

The researchers argue that future intentions cannot be gleaned from the crab's behaviour. Not only the crabs try to avoid giving away the clues about the plans, but behaviour is a reflection of previous motivation not the current motivation. To work out the motivational state and what determines it, the researchers have designed a clever experiment. They argue that if the crabs are poorly motivated, they should be easy to startle or distract with a novel stimulus. On the other hand if they are highly motivated, they should be much more likely to ignore the distraction and carry on with the job at hand.

By measuring the length of the startle response (the time spent hiding inside the shell after a small piece of black card is dropped near the combatant) the researchers found that the motivational state differs at an early stage of the contest according to the potential gain in resource value. "The absolute quality of the attacker's shell, and not the defender's shell, influences the decision to attack, but the subsequent decision to escalate depends upon the potential game quality", the researchers have explained.

Moth

Moth's Counter to Bat

It is well known that bats track moths through sonar. But recently researchers from USA have proved that the reverse is also true. Tiger moth species were studied with the help of ultra sensitive devices and the scientists were surprised to know a facet of moth's strategy for self-protection. The moth too emitted ultrasonic sounds as a reply for the action by the bat. These "Counterback" sound waves were so powerful that they reached up to 40 metres.

An inhabitant of North America, this particular moth is a favourite food for the bats known as big brown bats. However, these bats seldom get a chance to feast on the moth as the natural transmitter of the moth creates congestion in the signals that the bats receive. The natural sonar of the bat does not respond in this situation and therefore it can not locate the moth. It is the congestion of the network of these natural creatures that prevents one from hunting and protects another one from being hunted. And many a times, the moth beats the bat at its own game!

Penguin's Toil to Breed

In Antarctica where temperatures reach minus 40 degrees Celsius, emperor penguins congregate to breed and produce a single egg that the male incubates. The penguins huddle together not eating for four months until the egg hatches out. During that time they lose half of their body weight. About 80% of their insulation comes from their feathers, which, it has been discovered, grow all over their body leaving no skin exposed. No other bird on earth undergoes such an ordeal in breeding.

On land the birds use tiny muscles to erect the feathers forming a barrier of still air around their bodies. At the base of the feather is down, in which air is trapped close to the skin in small pockets. Each fibre has along its length a number of spikes or nodes. When fibres from neighbouring plumes push into each other the nodes

Penguin

Sea urchins

Ice worm

buckle into loops producing a dense structure of tiny air pockets. By trapping the air, the penguin's heat loss is drastically reduced. Dr. Julam Vincent of Reading University's Biomimetics Centre, Southern England hopes to copy the essential features of the penguin's insulation system and reproduce it in clothing.

Rain forests' Best Friends

The popular image of termites as timber munching pests or builders of towering nest mounds is badly in need of a makeover. In tropical forests, the vast majority of termites conform to neither stereotype, say researchers. Instead, they eat rotting vegetation in the soil and nest underground. They may be important to the survival of tropical forests as earthworms are to the health of gardens. Measurements of biomass and biodiversity of organisms in soil in West Africa show that soil dwelling termites accounted for more biomass than any other animal group (including humans). These subterranean species dig intricate networks of tunnels, shifting the soil and improving its aeration. By consuming the rotting vegetation they help to recycle nutrients taken from the soil by the trees and other plants. The findings will hopefully rid termites of their reputation as pests.

Termites

Unique Vision

Chameleons can rotate and focus separately to look out at two different objects at the same time! Its right eye is useful as a survival tool as it can be used for hunting food, and looking behind at the same time for predators. The left eye is needed for something in the front. This is in sharp contrast with humans and many other animals that use binocular vision. The special feature enables chameleons full 360° view around their body.

Chameleons

Eyes All Over

Sea urchins have several genes that are coded for a widely occurring eye protein, opsin. These photoreceptors are located on the tip and base of the tube feet all over the sea urchin's body. Hence these organisms see with their whole body.

Harvesting Natural Gas

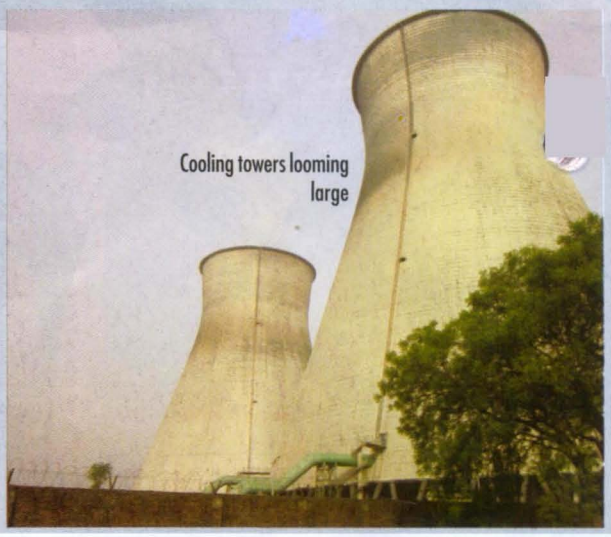
A species of worm, dubbed the ice worm, which lives off the chunks of methane ice, has been found on the floor of Gulf of Mexico. It is the first time that any animal has been found in the methane ice, according to Dr. Wharles Fisher, an Associate Professor of Biology at Pennsylvania State University, who discovered the centipede like worms. The discovery was made on a 10-day expedition sponsored by the National Oceanic and Atmospheric Administration's National Under Sea Research Centre. The flat pinkish worms may affect how sea-floor gas deposits form and dissolve in seawater, which could provide information on how scientists can harvest the natural gas.

Thus nature abounds with wonderful, novel organisms. It is for the explorer to unravel the incredible.

Dr. A. Krishna Murthy is a Retired Professor of Chemistry. Address: 2-7-592, Excise Colony, Warangal–506001; Email: avv122@yahoo.com
Dr. V. Pranitha is with the University College of Arts & Science, Subedari, Warangal

Nuclear Truth at Narora

V.K. JOSHI



Cooling towers looming large

THE all-too-common perception of a nuclear power plant as a radiation-spewing demon needs to change. A country such as ours needs power to develop and prosper. With fossil fuel resources depleting fast and coal-fired plants becoming environmental hazards, we need to look at a bouquet of power generating options. It would be ideal to use a combination of all kinds of power sources, like the hydroelectric, solar, wind, biomass, geothermal and even nuclear to meet our future power needs.

Nuclear energy is one of the most cost effective and clean energy sources. But the common query posed is: What about the radiation and the impact of such power houses on the water bodies nearby and the population? Due to security reasons nuclear power houses are not easily accessible to the common man and hence answers to such questions are difficult to come by.

Therefore, recently a group was taken on a study trip to the Narora Atomic Power Station (NAPS) to look at the surroundings around the nuclear power plant and also get an idea of the various arrangements there. This was a part of the steps being taken by the country's nuclear establishment to reach out to the masses and dispel their fears about nuclear power. As a member of the group, here is an account of what I learnt from this trip.

Cautley's Canal

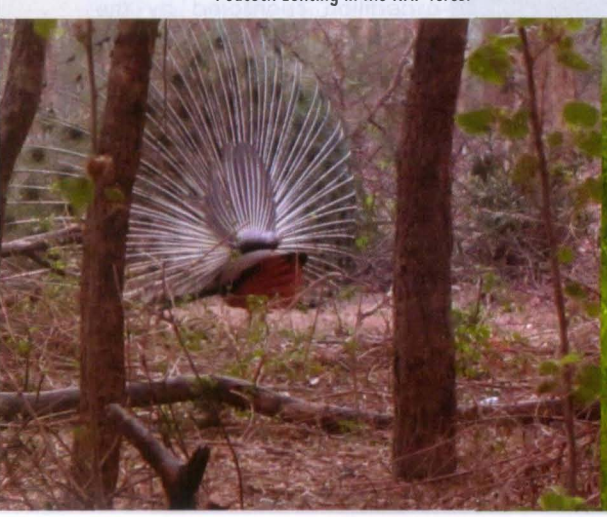
Colonel Proby Cautley, a British engineer and paleontologist of the East India Company, proposed digging a 350 mile canal from Bhimgoda in Haridwar to Kanpur, to meet the challenge of drought. His dream came true in 1840 and the actual construction began in 1843. Fear of the unknown always haunts the human mind and it is reported that saints at Haridwar vehemently protested this move. Somehow the British carried on with the excavation and the canal today caters to a vast territory of western and southwestern Uttar Pradesh, enriching it with cash crops.

What Cautley could not imagine was that in the future a nuclear power plant would come up on the banks of one of the tributaries of his canal in Bulandshahar district at Narora!

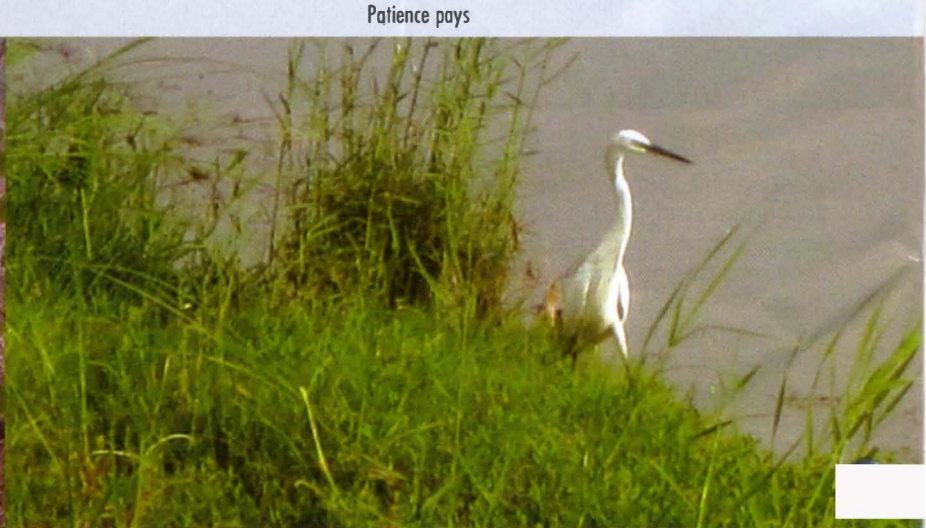
The rumors that hot water from Kudankulam nuclear power plant would wipe out the marine aquatic fauna, thereby affecting the very existence of the fisher folk in the area became the motive force that drove me out of the cool comforts of my home to the forests around the 1.6 km radius of the NAPS in the scorching summer heat.

As we entered the forest a troupe of monkeys appeared on the boundary wall, sitting in a row, as if giving us a welcome! And lo, there was a blue-bull, barely about ten feet away, trying to peep in to the vehicle. On the left a peacock male was dancing.

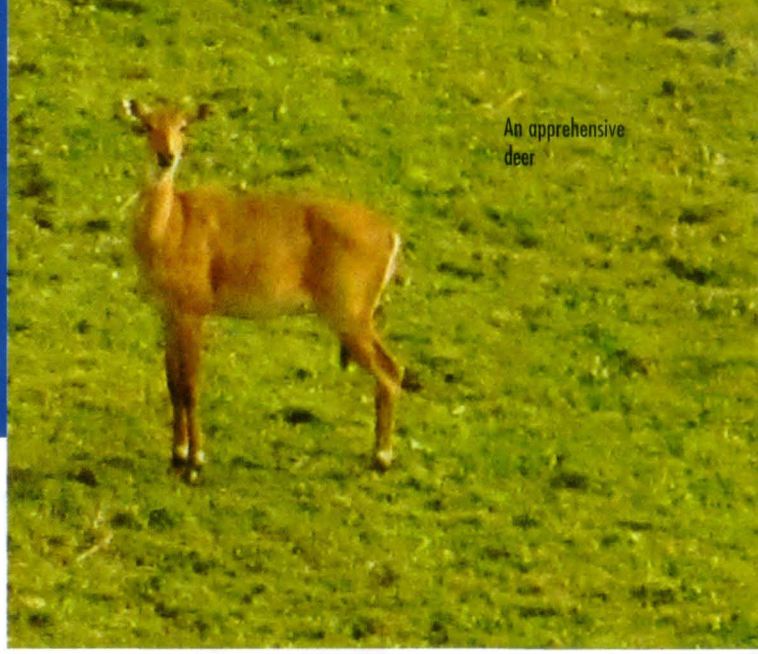
Peacock doncing in the NAP forest



Patience pays



The Nuclear Reactor is 'watched' round the clock from the control room, manned by a group of experts. It is a common belief in our country that engineers take things casually and are always caught napping in case of a mishap.



An apprehensive deer

Being a geologist by training and profession, I have had the privilege of traversing through some of the richest and densest forests of the country. Except for an occasional blue-bull or barking deer and of course peacocks no other fauna has been visible to me during those traverses at any hour of the day or even at night.

At Narora, the scene was unexpectedly different. No sooner had we entered the gate of the forest a troupe of monkeys appeared on the boundary wall, sitting in a row, as if giving us a welcome! And lo, there was a blue-bull, barely about ten feet away, trying to peep in to the vehicle. On the left suddenly a peacock's call drew our attention – a male was dancing, trying to entice three (presumably) females. The feathers shone brightly against the morning rays of the Sun.

As we drove ahead, all kinds of animals were playing hide and seek and almost unperturbed by the moving vehicle. There were a large variety of birds; I could identify Partridges, Pea fowl, amongst them. A wild Boar, a few Rabbits and a herd of Deer scurried past. The pugmarks on the sand were clear indication of the presence of a large population of fauna in the forest en-route the bridge on the Canal, a branch of the Ganga canal of Cautley. Incidentally, the canal serves as a source of coolant water for the nuclear reactor.

It was illuminating information that the coolant water is re-circulated within the plant and not a drop is allowed to go out. This applies to all the nuclear plants of the country, including Kudankulam. Rising like ghosts above the tall foliage, the white smoke belching, giant twin chimneys of the plant we learnt were actually the cooling towers, where hot water from the plant is sent to drop as a spray into a giant tank underneath. The superheated water thus cooled, is again sent back to the plant. The white smoke, which looked scary, was actually water vapour that escapes to the top of the cooling tower and is released in to the atmosphere. There were all kinds of birds hovering over it. Had it been radioactive smoke some of the birds at least should have dropped down!

And there were two parallel pipes carrying water from the power plant campus to the canal. This water was not the coolant water, but from the premises, where hundreds of people work at a time. Naturally a lot of water is used. Wastewater is treated before it is pumped back to the canal. At the point of confluence of this water with the canal, myriads of insects could be seen floating and hovering over the surface. A variety of water birds and fish were hungrily devouring these insects.

Mr. Pandey, a plant official, showed us ample photographs and videos to prove the presence of a rare bird like the Indian Skimmer, which is vanishing from all other sanctuaries but thriving in the water bodies and the Ganga at Narora. Yet another rare bird, highly susceptible to water quality, is the Red Crested Pochard. This bird too thrives at the spot where the water from the plant is discharged in to the canal, informed Mr. Pandey.

Birds apart, the Ganga near Narora has Crocodiles, Ghariyal, Giant soft shelled, cadaver eating Tortoise and even Dolphins. Tigers have been cited within the forest and the photographic evidence was with Mr. Pandey.

Why doesn't the population of rich fauna get affected by radiation? This question was haunting our minds, till we saw the Environmental Laboratory within the premises of NAPS. It was enlightening to know that even the gases that are released from the plant are not allowed to go out scot-free. They are passed through filters inside a 140 m tower. These filters take care of all the metals in the gases. Radiation if present beyond the threshold is checked inside the chimney and if there is even an iota of risk the plant is automatically shut down.

The Nuclear Reactor is 'watched' round the clock from the control room, manned by a group of experts. It is a common belief in our country that engineers take things casually and are always caught napping in case of a mishap. There can be no compromise with the safety and security of the plant, of the workers and of course of the population within a radius of 30 km, said Mr. Sharma, the Project Director of NAPS.

With a variety of checks and cross checks technicians at NAPS ensure that nothing but electricity goes out of the campus. Similarly, at the entrance the security personnel ensure that only genuine persons gain entry. A visitor is constantly under the hawk eyes of CCTV cameras.

When Thomas Edison, began supplying electricity to about 70 residences of New York in 1879 from his generator, there were hundreds of New Yorkers who shunned the idea and preferred to stick to kerosene lamps. It was the fear of the unknown that kept them away. Today, we cannot dream of spending even a second without electricity.

Likewise, the fear of nuclear power needs to be removed from the minds of our countrymen if we wish to see our country prosper and forge ahead.

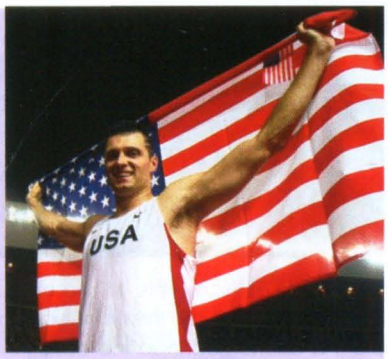
Mr Vijay K. Joshi is Former Director, Geological Survey of India, Lucknow. Address: 2, Improvement Trust Flat, Havelock Road, Lucknow: 226 001; Email: joshi.vijaykumar@gmail.com; Website: http://www.boloji.com/writers/vijayjoshi.htm; http://blogs.boloji.com/DogDom

FUN QUIZ

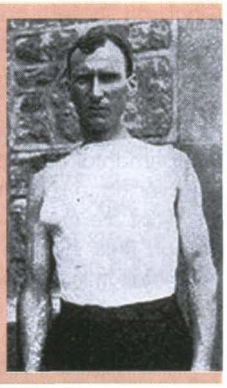
OLYMPIC SCIENCE

BIKRAM KESHARI JENA

1. He is the inventor of the erector set and the winner of the gold medal in pole vault in the London Summer Olympics in 1908. Name this athletic engineer?
a. Edward Cook
b. Alfred Gilbert
c. Edward Archibald
d. Charles Jacobs



2. His is the first ever recorded case of doping in the history of Olympics Games. He won the marathon at 1908 Games after allegedly taking "strychnine" and brandy. Name the athlete?
a. Thomas Hicks
b. Fred Lorz
c. Dorando Pietri
d. Johny Hayes



3. David Chaney is the man behind the development of this sporting equipment which, when introduced at the 1976 Games in Montreal revolutionized hockey for ever. This is the main reason why India suffered seriously as it could not match the European hockey teams in speed and skill. What is it?
a. Spikes
b. Graphite sticks
c. Synthetic balls
d. Artificial turf

4. In the ancient Olympics, athletes used to take which animal's meat as performance enhance drug (PED)?
a. Crocodile
b. Rabbit
c. Rat
d. Lizard

5. This cyclist was taking a drug called "amphetamines" which proved to be fatal. He died during the race at the Rome Olympics in 1960, which is the only drug-related death in the Games' history. Who is this Olympian?
a. Livio Trape
b. Lothar Staber
c. Knud Enemark Jensen
d. Antonio Bailetti

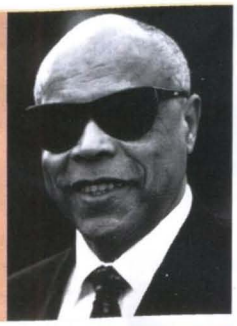
6. At the first modern Olympics in 1896, this graduate from the Princeton University went on to win both the shot put and discuss throw. After retirement, he became a great donator to science. He financed an archaeological expedition to Syria. Name him?
a. Robert Garrett
b. James Connolly
c. Francis Lane
d. William Hoyt

7. Who is the first athlete to have tested positive for performance enhancing drug (PED) in the Olympics Games (1968, Mexico City)?
a. Bjorn Ferm
b. Pavel Lednev
c. Hans-Gunnar Liljenwall
d. Istvan Mona

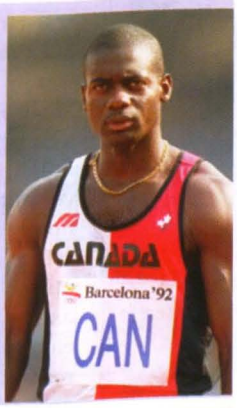
8. At which Olympics, synthetic track made of polyurethane was first used for athletics events?
a. Moscow 1980
b. Mexico City 1968
c. Munich 1972
d. Montreal 1976

9. Name the first Indian to be banned for using anabolic steroid in Olympic Games (Athens 2004)?
a. Sumita Laha
b. Ashwini Akunji
c. T Sanamancha Chanu
d. Pratima Kumari

10. This athlete from America won silver in long jump at the 1952 Helsinki Games. Later he became an engineer with 70 patents to his name. Who is he?
a. Meredith Gourdine
b. Jerome Biffle
c. Odon Foldessy
d. Charles Devonish

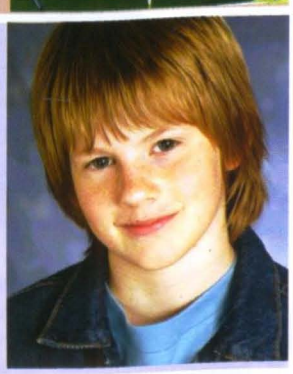


11. This Canadian sprinter had to relinquish his gold medal he won in 100 m at the 1988 Seoul Games, after he tested positive for stanozolol, a synthetic anabolic steroid. Name the athlete?
a. Carl Lewis
b. Ben Johnson
c. Linford Christie
d. Donovan Baily



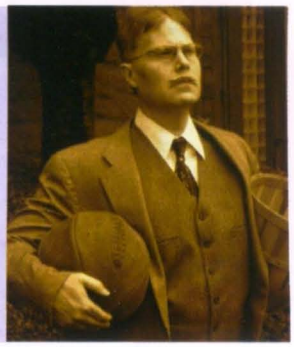
12. Two Olympians George Nissen and Larry Griswold patented which sporting device?
a. Synthetic track
b. Artificial turf
c. Trampoline
d. Spikes

13. After winning the 110 m hurdles at 1896 Games in Athens, this student from Massachusetts Institute of Technology became an electrical engineer. Name him?
a. Grantly Goulding
b. Frantz Reichel
c. William Hoyt
d. Thomas Curtis



14. A Nobel Prize winning Physicist used to play football with his brother in his local club. But his brother was selected for the national team, which won the silver in Olympic football in 1908. Who is the famous physicist?
a. Niels Bohr
b. Albert Einstein
c. Linus Pauling
d. Werner Heisenberg

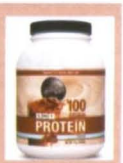
15. A doctor and a physical instructor by profession, James Naismith patented a game which became an official event at the Berlin Olympics in 1936. What is it?
a. Baseball
b. Volley ball
c. Table tennis
d. Basketball



16. Name the athlete who won four gold medals at the 1900 Paris Olympics and became a dentist later?
a. Walter Tewksbery
b. Alvin Kraenzlein
c. Meyer Prinstein
d. Thomas Curtis

17. Known as LZR Racer, the high-tech swimsuit patented in Portugal was used by swimmers for the first time in which Olympics?
a. Sydney 2000
b. Atlanta 1996
c. Beijing 2008
d. Athens 2004

18. He won a silver medal at the 1972 Munich Games as a part of the British 4*400 Relay team. He is credited to have created the world's first carbonated protein drink. Who is he?
a. David Jenkins
b. David Hemery
c. Alan Pascoe
d. Martin Reynolds



19. One of the famous Four Musketeers of the French tennis, winner of bronze medal in tennis doubles at the 1924 Paris Olympics invented the tubular steel racquet. Name this tennis star?
a. Jean Borotra
b. Jacques Brugnon
c. Henry Cochet
d. Rene Lacoste

20. Which basic sporting equipment was invented by Charles Booth?
a. Boxing glove
b. Nose clip
c. Starting block
d. Synthetic track

Answers:
1.b 2.a 3.d 4.d 5.c 6.a 7.c 8.b 9.d 10.a 11.b 12.c 13.d 14.a 15.d 16.b 17.c 18.a 19.d 20.c

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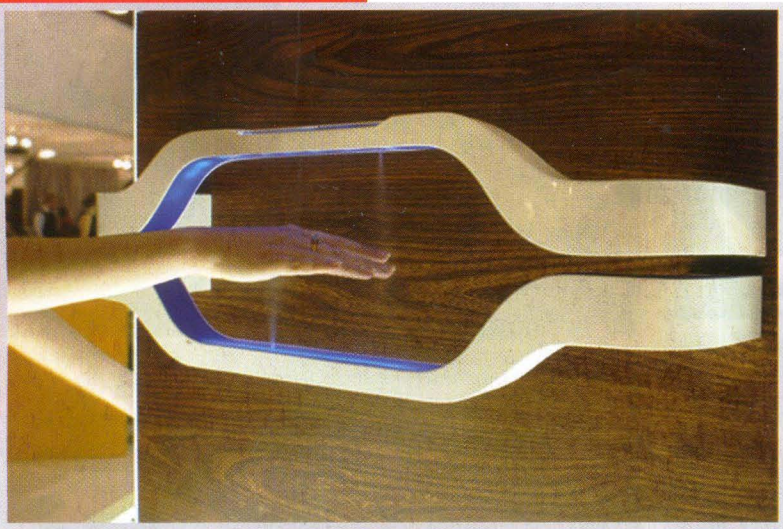


Hands Disinfection Device

The Hands Disinfection Device is a small machine that features two strips of sprayers which, when you place your hands between them, douse your digits with disinfectant. After a few seconds, the disinfectant evaporates and you are left with clean, germ-free, refreshed hands. The device was designed to improve the hand sanitation practices in restaurants and other public places. Rather than fiddling about with sinks this invention would let visitors easily keep clean hands with a minimum of effort.

Body Trackers

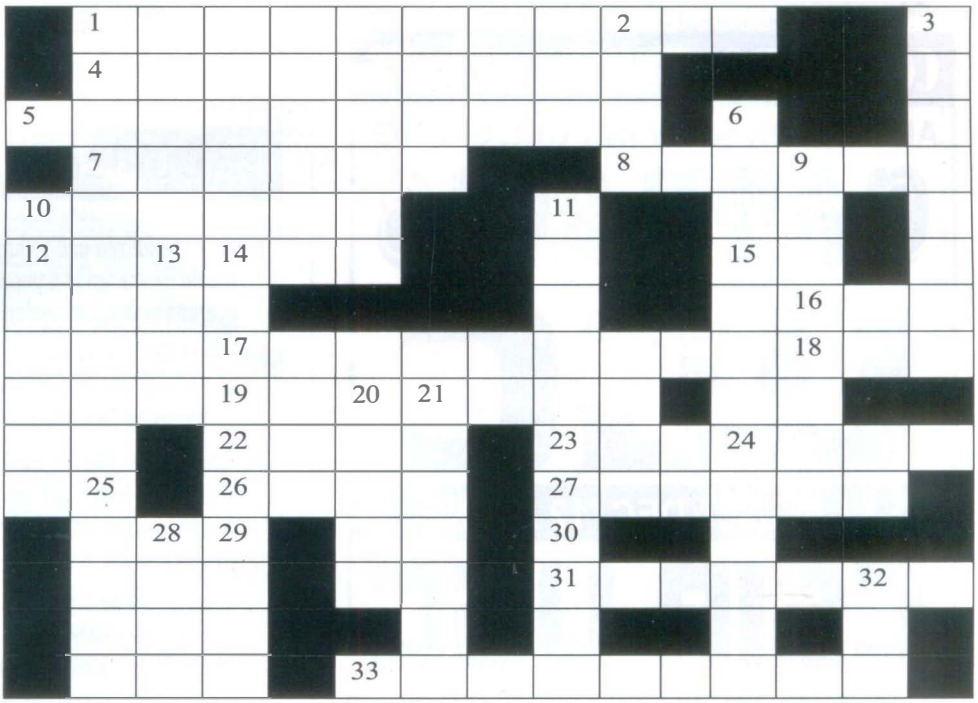
The basis band is the first continuous health tracker that measures heart rate at the wrist, rather than the chest or arm. An LED on the underside of the watch shines green light (which blood absorbs particularly well) onto the wearer's wrist, and a sensor detects how much light bounces back. Because blood volume in the wrist is greatest immediately after a heartbeat, the reflected light can be used to determine pulse. The watch also includes a three-axis accelerometer to detect motion, electrodes to measure galvanic skin response, and heat sensors to track skin and environmental temperature. Real-time data—steps, calories burned and heart rate—appears on the watch display, or

Headphone Technology to Help Hearing Loss

Custom-fitted hearing aids simply increase the volume of all ambient sounds and do little to help in conversation. To address the needs of the people, a Colorado company has reconfigured the noise-cancelling circuitry from its headphone line and created the first over-the-counter device that isolates and amplifies voices. Just as in a pair of noise-cancelling earphones, a microphone in the dime-size, in-ear Personal Sound Amplifier feeds noise to a microprocessor. Rather than eliminating sounds by generating competing frequencies, the Amplifier's processor isolates and selectively amplifies vocal frequencies while dampening ambient sounds.

Portable Washing Machine

Travel is one of the most enriching experiences in life, but it comes with its share of incredibly annoying things. Like having to travel light but not always having access to laundry facilities. And to solve this problem the Scrubba, a portable clothes washing system, is born. The Scrubba is a simple device that consists of a sealable bag with an interior flexible washboard that weighs just under 6.5 ounces. When folded up, the whole thing is about the size of a standard American Coke can. To wash your dirty clothes only takes 2-3 liters of water, a few drops of soap-like stuff and 20-40 seconds of manual agitation. Then you dry your things out and you're ready to hit the tourist trail again, smelling sweet and fresh.

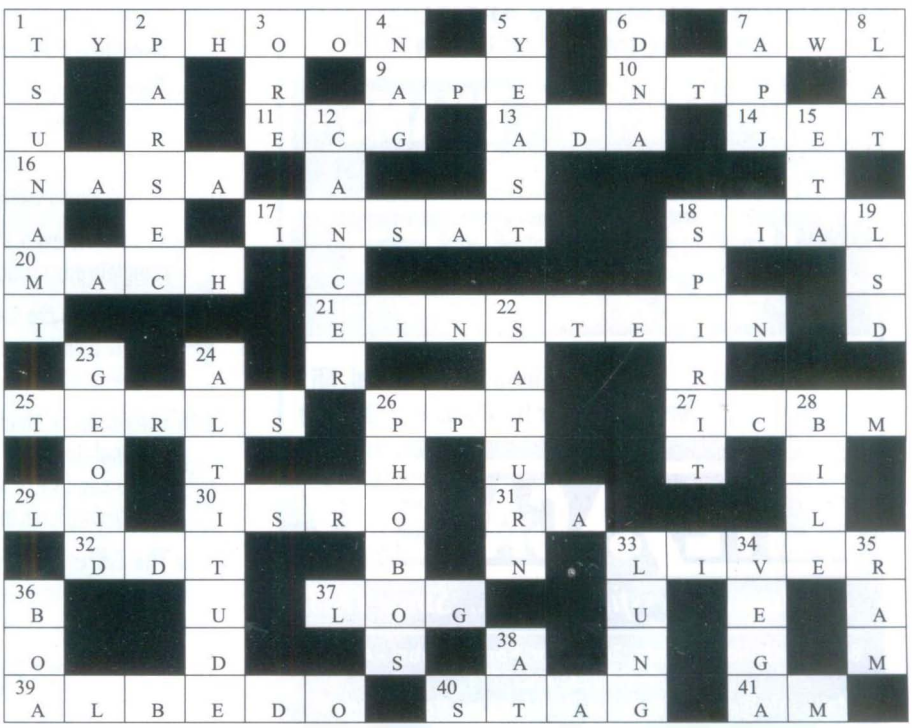


ACROSS

1. Compound that causes blood vessel block (11)
4. Alcohol deprived of hydrogen (8)
5. South American ant-eater (9)
7. Large bug that makes continuous high sound after dark, in the forest (6)
8. Wading bird with long legs and an upturned bill (6)
10. Microscopic hair like structure found on certain cells (6)
12. Severe pain in the chest caused by an inadequate supply of blood to the heart (6)
16. An insect secretion used as sealing wax and medicine (3)
17. A blood purifying technique and a substitute for the normal function of the kidney (8)
18. SI unit of electrical resistance (3)
19. Hormone that regulates glucose level in the blood (7)
22. Generic name for Salamander (4)
23. Movement of water molecules from hypotonic to hypertonic through membrane (7)
26. Female sheep (3)
27. Portion that contains vocal cords (6)
31. Element with same atomic number but different atomic weight (7)
33. Vitamin B1 deficiency disease (8)

DOWN

1. Substance capable of causing cancer (10)
2. Flightless bird of South America (4)
3. Sugary fluid produced in flowers (6)
6. Female deer (3)
9. One eyed organism or giant (7)
11. Coloured ring-shaped membrane behind the cornea of the eye with the pupil in the centre (4)
12. Place where bees are kept (6)
13. Disease, causing the joints to swell and become painful (4)
14. Element of halogen group and acts as an antiseptic solution with alcohol (6)
15. Arachnid attaches itself to the skin and sucks blood (4)
20. Moisture given out through the pores of the skin (5)
21. Womb (6)
24. Bivalve mollusc found for pearls (6)
25. A parallel bone with fibula (5)
28. Flesh of pig (4)
29. Alternate rising and falling of the sea to the attraction of the moon and sun (4)
30. Flightless bird of New Zealand (4)
32. Mendel experimented with this plant (3)

Contributed by Dr K. Venkataraman, AT2 Porkudam apts, Bypass Road, Madurai-10

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